Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. LV. NEW YORK, THURSDAY, FEBRUARY 17, 1910. No. 7.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

239 WEST THIRTY-NINTH STREET, NEW YORK

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TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico, $3.00 per year; Canada, $4.50 per year. All Other Countries, $6.00 per year. Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. Date on wrapper indicates the month at the end of which subscription expires.

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday of the week of issue.

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Entered as second-class matter at the post office at New York, N. Y.

The circulation of Electrical World for 1909 *was* 945,850. *Of this issue 17,250 copies are printed.*

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FINANCING ELECTRICAL ENTERPRISES.

Our foreign contemporaries recently contain reports of the formation of several new electrical banks, in particular a French bank of considerable importance, and now more recently a large undertaking in Zurich, as noticed in the Digest. There are similar powerful institutions in Berlin, Brussels and elsewhere. These represent a phase of financiering to which we have nothing exactly corresponding. They are specialized syndicates for the promotion of electrical projects and intended to aid in the systematic development of electrical interests on a large scale. The nearest relations in this country of these foreign electrical banks are the bond and security companies which have grown up around some of the large electrical manufacturing companies, as a measure of necessity, to help along the very projects on which the demand for electrical manufactures depends. Such concerns represent only a comparatively limited set of interests, however powerful they may be. It therefore happens that any activity in exploitation on the part of such companies is immediately twisted into an attempt on the part of the manufacturing companies to form power trusts, etc.; whereas, in point of fact, the bonding company has been regarded for the most part as an unpleasant necessity.

There is no electrical manufacturing company that would not, if it could have its choice, prefer to have customers for its apparatus ready and willing to pay cash, thereby obviating any necessity for handling securities. The foreign electrical banks, however, represent many interests, so far, at least, as outward appearances indicate. In the Zurich bank, institutions and manufacturers from a half-dozen countries participate, and it, like its predecessors, seems to be a genuine part of a systematic effort to help along profitable enterprises. Of course, this international character checks what otherwise might be a strong tendency toward the control of such an institution by a single group of manufacturing interests. Where, as in this case, the operations assume an international scope, no single manufacturer can expect to have a greatly preponderating influence so far as getting business is concerned. In this respect the foreign scheme is sounder than the corresponding American financing companies with their obviously narrow affiliations. Perhaps the conditions here forbid systematic effort along the line here under consideration, but we hope not. The American tendency toward aggregation as such often operates to defeat important enterprises through unofficial, but none the less potent, relations between financial interests. When there is no special provision for financing electrical matters, they are liable long to remain unfinanced on account of petty jealousies between bankers, who have no particular interest in electrical matters, anyhow, other than from possible handling of their bonds. The foreign scheme, with its direct specialization and wide range of interest, appears to be a good one, although whether it could be grafted upon the American financial system is another matter.

RELATION OF LUMINOUS INTENSITY TO POWER CONSUMPTION IN INCANDESCENT LAMPS.

An article by Mr. C. Chéneveau, noted in the Digest, has recently appeared in *La Revue Électrique* detailing some important experimental and mathematical deductions concerning the relation between light and power in incandescent lamps. Dr. Steinmetz recently published in our pages the result of a special series of photometric measurements on a tungsten lamp subjected to varying terminal voltage. He showed that, to a very fair degree of approximation, the horizontal candle-power of the lamp increased as the 1.6th power of the terminal voltage. He also showed that if the filament radiated energy as the fourth power of the absolute temperature, and if the resistance of the filament increased in direct proportion to the absolute temperature, then it would follow that the radiated energy would increase as the 1.6th power of the voltage; so that if within a short range of temperature the light was proportional to the emitted radiation, the observed facts would be accounted for. According to Voit and Berninger, the mean spherical candle-power of a carbon incandescent lamp increases with the cube of the power consumed by the lamp, whereas in the case of a tungsten lamp it increases less rapidly with the power. A special research was undertaken by Messrs. Féry and Chéneveau in this direction, the results of which have appeared in a recent number of the *Bulletin* of the Société Internationale des Électriciens. It appears that a tungsten filament radiates energy in proportion to the four-sixth power of the absolute temperature, instead of like carbon, as the fourth power. Using this experimental result, a simple exponential formula was found expressing the candle-power of any incandescent lamp in terms of the power consumed and of two constants, one fixed by the dimensions of the filament and the other by the physico-chemical nature of the filament.

According, then, to the above results, a tungsten lamp is more efficient than a carbon lamp for at least two reasons. First, it withstands safely a higher working temperature—about 1900 deg. C. for tungsten, as against some 1800 deg. C. for carbon—and all materials become more efficient as illuminants when their working temperature is raised. Second, whereas the power radiated by carbon, and by black bodies in general, increases with the fourth power of the absolute temperature, that of tungsten increases faster; so that a smaller increase in temperature serves to add 1 per cent to the radiation than in a carbon lamp. If the foregoing results are reliable, it should follow that from any suitable pair of observations not too near together, connecting the candle-power and watt-consumption of a carbon or a tungsten lamp, a formula and full curve of candles against watts should be derivable. It will be interesting to learn whether this possibility is realized in practice.

ELECTROLYSIS BY EARTH CURRENTS.

One of the most perplexing questions in the work of the trolley-system electrical engineer is how to minimize the danger of electrolytic corrosion in metallic pipes, beams or cable sheathings lying in the ground near the return conductor system. In some cases this corrosion has been extensive and costly to repair. A difficulty in arriving at the facts of such a case is due to the buried state of all the metallic parts that may be in danger, so that inspection is hindered. Moreover, the parasitic currents which do the mischief are not confined or channeled, and thus are hard to predetermine or compute. Except in rare locations, such as among ore deposits, the crust of the earth is found to be of non-conducting substances. Dry soil, mud, clay and gravel are all fairly good insulators. It is only the moisture suspended in such soils that conducts electricity to any appreciable extent. The resistivity of ordinary damp soil is many millions of times greater than the resistivity of copper. The drop of pressure produced in a definite prism of so-called good-conducting soil by a given current strength is consequently many millions of times greater than would be produced by that current in an equal prism of copper; or, to state the same proposition in other terms, the resistance of the prism of earth would be many millions of times the resistance of a prism of copper of the same dimensions. Nevertheless, if we bury a ground plate in ordinary moist soil and send a current thence into the ground, the radiating current soon spreads over such a very large hemispherical surface that the resistance of the earth becomes indefinitely small beyond a range of a few feet. The drop of pressure in the ground connection will therefore be almost wholly confined to within that range.

In a direct-current railway system it is a very general practice to carry out an electrical survey over the streets through which the railway passes by noting the differences of potential between the tracks and buried pipes or cables during busy hours of the day. If the said pipes are negative to the track, then any parasitic current which can flow in that immediate vicinity is from the track to the pipe. This current may possibly corrode the rails, but cannot corrode the pipe, since a cathode is exempt from electrolytic corrosion. If, however, the pipes are positive to the track, then if a current does flow between them in that vicinity it will occasion electrolytic corrosion of the pipe. All parts of the street system in which the buried metal is permanently positive to the track are marked off as lying in the danger zone. Nevertheless, as pointed out by Mr. Del Mar, in an article on page 405 this week, it does not follow that there will be any appreciable corrosive current from the pipes whenever they show a positive potential difference over the track. This fact only indicates the possibility of corrosion. If the pipes lie buried at a considerable distance from the track, there may be a very appreciable permanent potential difference between them without current leaving the pipes to any appreciable extent, owing to the large drop of potential in the immediate vicinity of the track and to the pipes being enveloped by soil at the ground potential.

Although, as the article points out, there may be plenty of unharmed buried metal in the danger zone, yet there is always a possibility of danger in this zone. Although much can be done by careful electrical testing in reducing electrolytic danger by improved bonding and rail connecting, yet the best protection of all is obtained by limiting the drop of potential in the track. An ideal condition for this purpose, if economy were no object, would be to use insulated outgoing and return feeders in pairs like large twin telephone conductors, connecting the former to the trolley and the latter to the track underneath. By installing over the system a considerable number of such double-return conductors it would follow that the current leaving the station by any given positive insulated feeder would return on its mate, the corresponding negative insulated feeder, without having traversed any long distance of track and with very little drop of pressure in the track, assuming the rails to

be properly connected. The above plan would greatly add to the cost of copper conductors in a street-railway system. As pointed out in the article, however, satisfactory results can be, and frequently are, obtained by carrying insulated negative track feeders from the central station to the rails at various points, thereby placing the drop in the return largely in the insulated feeders, instead of in the ground return.

THE WORK OF THE REICHSANSTALT.

There is a time-lag in the affairs of men which is a function of their complexity. The apparent motions of the sun, moon and stars are so regular and systematic that national astronomical observatories print them four and five years ahead, or with negative time-lag. On the other hand, the records of the U. S. Weather Bureau have to be made up from sources thousands of miles apart, to be collected and collated, so that they are published with a time-lag of several months. The annual report of the German Reichsanstalt is heavy with labor and voluminous with diversity. It regularly emerges from the press with a time-lag of about a half year. The report for 1908 covers a wide range of research in mechanics, physics and chemistry, both pure and applied. It is a sermon upon the many-sidedness of modern science, and on the hopelessness of all knowledge being made the province of any one man, however highly gifted or trained. The all-knowability of science was all very well for Moses, and may have been attemptable in exchange for modesty in Bacon's day; but to-day a scientist is fain to be content if, with a rough idea of the lay of the main continents of knowledge, he can call some little corner of one field his own.

Like our own Bureau of Standards at Washington, the Reichsanstalt at Charlottenburg has a national value and importance far in excess of its material inventory. It is not merely that the Lares and Penates of the nation are deposited there, in the standards of length, mass and other precious physical quantities. Nor is it merely in the fact that through the communion maintained between the various national laboratories on these fundamental standards, international unity and civilized co-operation are maintained. A large part of the national value and importance of the Reichsanstalt to Germany is purely psychological, and springs from the complexity of modern scientific knowledge. In the modern large-scale operations of a community, say, in building, railroad laying, or in manufacturing, the great majority of the workers act under direction, and not of their own judgment or selection. The individual worker is able to exert himself to the full measure of his physical and moral endowments, confident that although he himself has but very limited notions as to what or why he works, the officer above him knows. Human beings never work effectively if they lose faith in the intelligence of the administration which dictates their duties. The men in industrial armies rely on the intelligence of their foremen, and the foremen on the intelligence of the engineers. The engineers, in their turn, will falter and hesitate at every new and untried step if they are not heartened and supported by the work of the scientists whose business it is to investigate the workings of Nature in various directions and interpret the results to the engineer in a form which he is able to apply. A properly organized national laboratory is thus, in a sense, at the basis of all national industrial development. Only a nation whose industrial work is stereotyped, and immutable as the laws of the Medes and Persians, can dispense with a Reichsanstalt of its own.

A number of interesting electrical researches are described in the report, covering a variety of applications. As a particular instance, reference may be made to a three-phase arrangement of singing arcs, generating high-frequency forced oscillations for the measurement of wave-lengths in wireless telegraphy. An ingenious arrangement of the singing arc is also described for maintaining its operation as nearly as possible uniform.

GAS COMPETITION IN SMALL TOWNS.

It is difficult to understand the panic-stricken way in which some managers of small central-station companies think of the possibility of the establishment of a gas plant in their town. We refer now to towns of less than 8000 inhabitants. It has never been demonstrated, so far as we know, that a gas plant in a town of from 3000 to 7000 inhabitants is a bonanza for its owner. Nevertheless, some small central-station companies have been persuaded to put in gas plants themselves rather than face the possibility of the competition of an independent gas company. Several managers we know would much prefer to let the "other fellow" make the investment in a gas plant in towns of this class. In such towns if the central-station lighting business has been properly developed and looked after, there is practically nothing to fear from the displacing of the electric light by gas. Of course, when the gas plant is new there will be a few disgruntled electric consumers (and there are such in every town) who will go over to gaslight for a time.

However, in those cases where the electric lighting company is giving good, reliable service and is using tungsten lamps, so as to give the consumer the most for his money, it is not reasonable to suppose that any considerable number of consumers will go to the expense of piping for gas, to say nothing of the various undesirable and inconvenient features of gas lighting after it is installed. The most that a gas company can hope to do at the present day in a town where there has heretofore been good electric service and no gas is to get the gas-range business, and this business does not in the least interfere with the central-station company's business, as it is carried on to-day. This is the experience of the newer cities of the Far West where gas is used for fuel, but where only a small percentage of houses are piped for gas illumination—only 5 per cent in Tacoma. Of course, the introduction of gas might prevent the installation of a limited number of electric cooking outfits, but as yet electric cooking has not reached such a state of development that the possible loss of revenue from this source is alarming. A properly managed central-station company in the class of towns under consideration yields a good net profit on the investment. Can the same be said of gas companies in towns of this size, after depreciation on the usual street pipe mains is deducted? In view of these facts, it is a question worth considering by any small central station which contemplates putting in a gas system, whether it had not better take the money it would spend in putting in a gas plant and spend it on improvements of the electric system, or in some of the other allied industries, such as ice-making or exhaust-steam heating, which utilize the by-products of the electric plant, and which materially increase the net returns on the investment.

St. Louis N. E. L. A. Convention.

President F. W. Frueauff, of the National Electric Light Association, visited St. Louis last week to confer with the local people there regarding the annual convention. He was accompanied by Mr. Frank H. Gale, chairman of the exhibition committee, and Messrs. J. C. McQuiston, J. Ayer and Walter Neumuller. The general conference was attended by Mr. Alton S. Miller, general manager of the Union Electric Light & Power Company, of St. Louis, and others representing the local interests. Before President Frueauff and his associates left St. Louis they were satisfied with the facilities offered and the exhibition committee proceeded to arrange details for that part of the convention in which they were interested. All of the meeting rooms for the convention, as well as for the exhibits, will be in the handsome new Coliseum, and all indications point to an excellent convention. As previously reported, the convention is to be held the week beginning May 23.

Philadelphia Electric Show.

Philadelphia's first electrical exhibition was opened in the First Regiment Armory, at Broad and Callowhill Streets, on Feb. 14, under very auspicious circumstances. City Hall was especially illuminated for the occasion and searchlights played on the statue of Franklin which surmounts the tower high above everything else in the Quaker City. Arches of incandescent lamps were stretched across the wide roadway of Philadelphia's principal thoroughfare from the City Hall to the armory, and electric signs announcing the show and its location were suspended at the street intersections. In the armory itself standing room was at a premium long before Mayor John E. Reyburn touched the button officially opening the exhibition at 8 p. m.

The building is rather small for an exhibition of this kind, but was the only structure available for the purpose. The managers of the enterprise, however, have made an admirable showing in spite of this fact, and the exhibits are sufficiently diversified to hold the interest of the veriest novice in the art. The decorative scheme may be seen from the accompanying engraving. White and gold are the predominating colors,

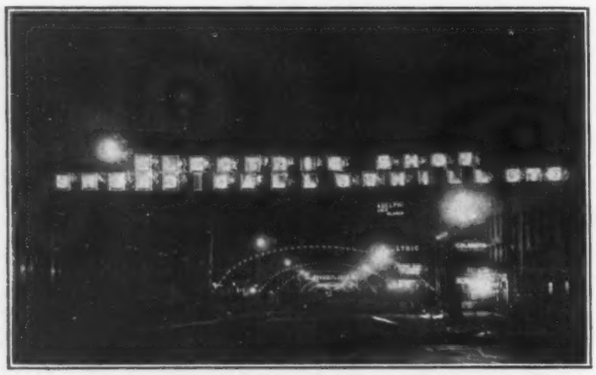


Fig. 1—Signs and Arches on Broad Street, Philadelphia.

and a fluffy azure sky hides the roof trusses of the building. In the center is the booth of the Philadelphia Electric Company, the largest in the show, and on top of the dome is a gilded statue of Franklin, from whose hand runs an electrically lighted string attached to an electric kite suspended from the roof over the center aisle.

A good idea of an exhibition may be obtained from the character of its exhibits, and a brief synopsis of these is given elsewhere in this issue. It will be remembered that in the exploitation of its industries through public exhibitions Philadelphia, until recent years, has held a pre-eminent place, and was the pioneer in publicity of this sort. Its electrical exhibition in 1884 was the first of its kind in this country, if not in the world, and the exhibition given in 1898 reflected the state of the art at that time. To be sure, after a lapse of 12 years great strides have been made in electrical manufacture and in the manifold applications of central station energy, and the enthusiasm displayed by Philadelphians in the present show augurs well for the local industry. The exhibitors include the electrical public service corporations, the city electrical bureau, the University of Pennsylvania, the principal electrical contractors and dealers in Philadelphia and the leading electrical manufacturers in the country.

The exhibit of the University of Pennsylvania gives a historic touch to the occasion. The Drawbaugh telephone transmitter, celebrated in the history of telephone litigation, is shown, together with two old Reis transmitters, antedating the Bell invention by 15 years. Another relic is the original platinum

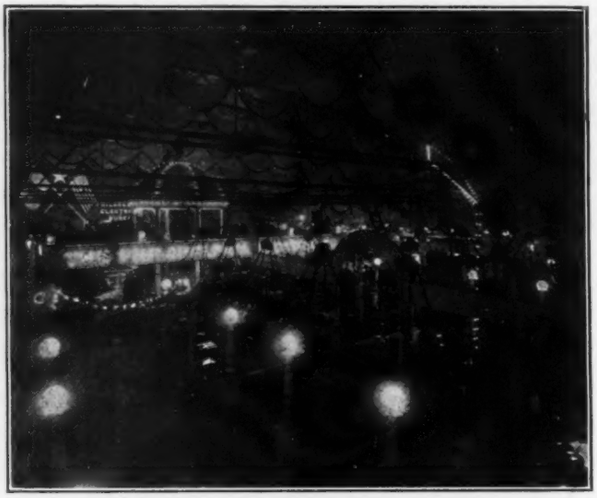


Fig. 2—General View of Interior of Exhibition Hall.

lamp used by Edison. Dr. Ebenezer Kinnersley's synopsis of his lectures on "The Newly Discovered Electrical Fire," delivered in 1757, is also on exhibition, as well as a card of admission to his lectures. The admission notice is printed on the back of a playing card—the six of diamonds—bristol board evidently being quite expensive in Colonial days. The show will run for two weeks, closing on Feb. 26.

Developments in the Chicago Traction Situation.

As is generally known, the four elevated railways of Chicago, some of them with several branches, use the Union Loop, in the central portion of the city, in common. As the traffic has increased by the growth of the city and by the building of additional branches to existing trunk lines, the congestion on the loop has become very pronounced, and it is self-evident that some remedy to relieve this situation must be found speedily. The local transportation committee of the City Council has the subject under consideration, and several expedients have been suggested. One is the lengthening of the station platforms of the loop so that two five-car or, possibly, six-car trains could be loaded on one track at the same station at one time. The loop is a double-track structure, one track serving for two of the four contributing systems. However, this would only be a temporary expedient, and would make the elevated railway structure in the central business district still more objectionable as a barrier to light and air with reference to the street beneath it.

Another suggestion which is receiving considerable attention is the through-routing of trains; that is, making an arrangement between the different companies so that trains from each of the roads will pass through the central district and on to another line rather than making the circuit of the loop and returning immediately to the line from which it came. This proposal would at least double the capacity of the loop, for each train, instead of going all the way around the structure,

would only go half way around it. However, it is difficult to put the plan into execution, because it would make very long hauls and would require very careful adjustment to preserve the equities of the different companies in the elevated railway traffic of the city. By this plan a South Side train, for instance, would be making no money for its owner while running on the North Side, but it is proposed to balance the exchange so that there will be a corresponding North Side train on the South Side, and the actual result ought to be nearly the same as by the existing plan.

Mr. Starring, the president of the Northwestern Company, operating on the North Side, is believed to favor through-routing, while Mr. Weston, of the South Side company, is believed to be opposed to it. The preferences of the two West Side companies have not been publicly expressed. The companies naturally wish to be assured that they can afford to make the long haul for 5 cents or else be permitted to charge two fares. Obviously the difficulties would disappear, or be greatly mitigated, if the four companies were combined under one ownership or one management; but, although this plan has been often proposed, it has not been found possible to bring about the merger as yet, although it would seem to be likely that this might be accomplished at some future time.

SUBWAYS PRACTICALLY ASSURED.

In the meantime, the necessity for a system of street railway subways under the central business district becomes increasingly apparent. The municipal government seems to be pledged to the construction of such a system of subways, and this subject is also under consideration by the local transportation committee of the City Council. On Feb. 7 this committee announced that the mayor had appointed Mr. Bion J. Arnold chief engineer of subways. Mr. Arnold is now chairman and chief engineer of the Board of Supervising Engineers, Chicago Traction, which is in charge of the rehabilitation of the surface street railways of the city—a task now well on its way toward completion. Mr. Arnold will retain both his positions with the Board of Supervising Engineers, at least for the present. In connection with his general investigations into the traction situation in Chicago, he has already made an exhaustive study of the subway situation, on which he made voluminous reports in 1902 and 1906. There have been other reports and other suggestions and offers of construction companies in connection with the proposed subways, and it will be the duty of Mr. Arnold to examine this mass of material and in due course prepare for the local transportation committee actual construction plans for these subways.

Mr. Arnold gave some indication of his views on the subject in a speech made at the recent annual dinner of the Western Society of Engineers. Mr. Arnold said that not only is the surface of the streets needed in the downtown district, but also the subway space under the streets for street railway transportation. Probably space above the streets will also be needed for elevated railways. If there is any scheme which will dispense with elevated railways, Mr. Arnold would favor it, but he is inclined to be doubtful that this can be done, owing to the great increase in the traffic.

Referring to a suggestion made by Mr. B. E. Sunny, Mr. Arnold was rather doubtful whether it would be practicable to operate the north-and-south cars under the surface in subways, leaving the surfaces of the streets free for east-and-west cars. As to whether a double-deck subway shall be used, there are advantages and disadvantages to be considered, and the suggestion should be carefully studied. All the elements entering into the transportation problem—that is, the surface, elevated and subway railways, as well as probable future growth of the city—should be considered together as far as possible, with the idea of developing in the end a coherent, comprehensive plan. Mr. Arnold said that he thought the consolidation of the companies—that is, all the surface and elevated companies—and the introduction of the through-route principle on all the lines would make a great reduction in operating expenses. Furthermore, it may be that, with the increase of traffic, what might have been the loss to one company under the present individual ownership would be compensated by the advantage to another, so that if consolidation were effected the net result would be a gain. However, this is rather problematical, but Mr. Arnold declared himself unreservedly in favor of consolidation.

The surface street railway companies are pledged by the traction ordinances to contribute $5,000,000 to the construction of subways. Further, there has accumulated in the city treasury about $4,000,000 from the city's 55 per cent of net profits of surface street railways during the last three years. This amount has been set aside for subway construction, so that, all told, $9,000,000 or more is now available for the beginning of actual work. The chairman of the local transportation committee declares that the time for academic discussion of subways is past and the time for action is at hand. Mr. Arnold says that he will organize an office force at once to assist him in preparing the subway plans.

Vancouver Hydroelectric Plant.

The Western Canada Power Company, of which Mr. R. F. Hayward is general manager, has commenced the construction of a hydraulic plant 35 miles from Vancouver City. The plant is designed for four 13,000-hp turbines, to drive four 7500-kw generators. The orders for the machinery for two units have been placed and the work is now proceeding rapidly. The power plant is located on the Stave River, which flows into the Fraser River at a point called Ruskin, about 35 miles due east of Vancouver City. Seven miles above the power site is Stave Lake, a large body of water fed by glacial streams and having a total area of about 10 square miles. By constructing a dam not more than 50 ft. high, on a solid granite foundation above the power-house site, 7 miles below the foot of the lake, a reservoir will be formed having a surface of nearly 20 square miles, and rendering available a fall which will vary from 100 to 120 ft., according as the reservoir is at high or low level.

The turbines, which are of the horizontal, double Francis type, designed for 225 r.p.m., are being built by the Escher-Wyss Company, of Zurich. The two generators and the step-up and step-down transformers will be built at Peterboro, Ont., the order having been let to the Canadian General Electric Company. The electrical energy will be transmitted over a 600,000-volt steel-tower transmission line to the city of Vancouver, in which city and in its neighborhood it is expected to find a market for all the energy. The work is now well in hand and delivering of energy will begin in the early part of next year.

Three miles lower down on the same river the company has a second power site with the same fall as the first, which can ultimately be developed. It can, therefore, if the market eventually demands it, develop power in the most economical manner to a maximum of from 80,000 hp to 100,000 hp.

Canadian Opposition to St. Lawrence Hydroelectric Development.

The application of the Long Sault Development Company and the St. Lawrence Power Company for authority to dam the Long Sault Rapids, in the St. Lawrence River, near Cornwall, for development purposes met with very strong opposition when the application came up for consideration by the International Waterways Commission at Toronto on Feb. 8.

The most serious opposition was offered by the Ontario Government, which claimed that the Canadian side of the rapids is under the control of the Province of Ontario, and Hon. Adam Beck, chairman of the Ontario Hydroelectric Commission, asserted that the commission had offered the lake front municipalities cheaper energy than they could obtain from the proposed development. The National Conservation Commission for Canada also sent a report strongly condemning the proposed system of dams.

It developed during the argument that, while the ultimate

total amount of power to be developed is 600,000 hp, only 100,000 hp will be developed in Canada, the balance being produced on the United States side of the boundary. The proposition is to erect two power houses, both of which will be on New York territory. One of the dams will be wholly within New York, and the other partly in New York and partly in Ontario. The former dam will be placed between Long Sault Island and Bernhart Island across the rapids; the latter will be near lock No. 20, on the Cornwall Canal. A 42-ft. dam would permit about 650,000 hp to be developed.

The members of the commission present at the meeting were: George C. Gibbons, London, chairman; Eugene Coste and William J. Stewart, of the Canadian section; General Ernst, Washington, chairman; George H. Clinton, of Buffalo, and Prof. Haskell, of Detroit, of the American section of the commission.

Mr. John Kennedy, engineer of the Montreal Harbor Commission, expressed the opinion that the Long Sault Rapids could be wisely and safely dammed, but that such a work should be carried out by the Government as part of a general scheme of river improvement.

Mr. J. W. Rickey, one of the Long Sault Development Company's engineers, outlined the technical work necessary to carry out the scheme. The company expected to complete the works for a total development of 600,000 hp, of which 100,000 hp would be generated on the Canadian side of the river.

There were present from Brockville and other municipalities adjoining the rapids, representatives, all of whom were in favor of the scheme. It was stated that energy costs $40 per hp-year for 24-hour service at Brockville, while it was expected, with the development proposed, to secure it at this point for from $15 to $18 per hp-year.

After hearing arguments of an imposing array of eminent counsel representing the various interests concerned, the commission adjourned to meet at Buffalo in about a month's time, when it was intimated that the report would be made public. From certain remarks made, it is expected that the commission will decide in favor of the Dominion Government granting the application of the development companies.

An Electric Light Franchise Sold at Auction.

A franchise for furnishing electrical energy to the city of Wheaton, Ill., which was recently advertised for sale to the highest and most responsible bidder, as noted in these columns, has been awarded to the Western Union Gas & Electric Company, of Aurora, Ill., in consideration of $27,250. The upset price was $20,000. The city canceled its agreement with the company which has been furnishing its electric service, as it deemed the latter's rates too high and in excess of those charged in neighboring towns. The ordinance prepared by the city authorities, fixing the rates for lighting and motor service, was accepted in its full terms by the successful bidder. By the terms of the agreement the franchise will continue in force 30 years, although at the end of 10 years provision is made for a readjustment of the rates.

Proposed Maryland Public Utility Bill.

The Maryland public utilities bill in its amended form is much more strict, so far as the corporations are concerned, than in its original form. When the utilities bill, which had been approved by Governor Crothers and his cabinet, was finally introduced at Annapolis, it was discovered that a number of amendments had been inserted, and the first report was that these had been inserted surreptitiously by interests hostile to the bill. Investigations of the public-service corporation lawyers indicate, however, that the changes were made by the friends of the bill, and that the net result of them is to tighten up the restrictions on the public-service corporations.

Attorney-General Straus, the drafter of the bill, when shown the list of changes, many of which had been inserted at his suggestion, said that they were made to strengthen and perfect the bill and were the result of information received from the Public Utilities Commissions of New York. Embodied in the changes are recommendations of the New York commissions now before the New York Legislature.

Complaint has been made by the corporations that the New York and Wisconsin laws, recognized as the most radical in existence, were combined in framing the bill for the State of Maryland. Many other States have corporation commissions less sweeping in the scope of their power, which would, it is claimed, have been more suitable for Maryland. It is claimed that all of the plans that were being outlined for extensions to the electric railway systems into the counties have been held up awaiting the action of the General Assembly and a full knowledge of what the law will mean.

The provision of the law prohibiting any corporation from holding 10 per cent of the capital stock of another is criticised most severely. In financing new enterprises in Maryland it is customary to ask one of the big trust companies in Baltimore to market the bonds, in exchange for which service the trust company receives some of the common stock, which is usually more than 10 per cent of the issue. It is claimed that the limitation of the premium in common stock will prevent the trust companies from undertaking this service, as new enterprises are always regarded as hazardous. While the corporations are disposed to regard the whole situation with a great degree of uneasiness, the action of the Legislature is by no means assured. The general opinion is that a public-utilities bill will go through, but it is by no means certain that the bill prepared by Attorney-General Straus will be the one enacted. One of the changes above referred to brings "persons" as well as corporations under the operations of the law, to cover the case of an individual engaging in the business that public-service corporations almost invariably perform. Some of the changes, Mr. Straus said, were made with a view to reinforcing the right of the commission to decide what were reasonable rates at which gas and electricity could be sold.

Mexican Hydroelectric Developments.

The Guanajuato Power & Electric Company and the Chapala Hydroelectric & Irrigation Company have entered into a written agreement whereby the territory of central and western Mexico is apportioned between them for the operation of their respective power transmission lines. The electric generating plants of these two concerns are situated about 150 miles apart, but with the extension of their transmission lines their business interests began to clash, and there was a brisk competition as to which should obtain control of the electric power business of the State of Aguascalientes. The Chapala Hydroelectric & Irrigation Company won the fight there, and was after an exclusive concession for furnishing electric power in the States of San Luis Potosi and Zacatecas, when a mutual agreement was reached as to division of the territory.

The contract was signed Mr. Henry Hine, president of the Guanajuato Power & Electric Company, and Mr. Emile Pinzon, director-general of the Chapala Hydroelectric & Irrigation Company, on behalf of their respective concerns. It is provided that the power and lighting business of the States of Jalisco, Michoacan, Aguascalientes, Guanajuato, Zacatecas and San Luis Potosi shall be divided on an equitable basis between the two companies. The agreement provides that the Guanajuato company shall construct a transmission line to San Luis Potosi and the Chapala concern shall extend transmission lines to the cities of Aguascalientes and Zacatecas, the former is allotted 10,000 hp and the latter 6000 hp. The line to Aguascalientes will be 110 miles long and that to Zacatecas about 190 miles long. The Guanajuato Power & Electric Company will cover a portion of the State of Jalisco with its lines. It will meet the Chapala company's lines at Ocotlan, on Lake Chapala. It already has a low-voltage line to Ocotlan from its Zamora hydroelectric plant, which will be worked at high tension. The two systems will connect, and under the terms of the agreement will furnish each other with electric power when necessary.

The agreement also establishes prices to be paid by customers of the respective companies.

An official report has just been issued by the street-railway department of the Chapala Hydroelectric & Irrigation Company which shows that 6,400,000 passengers were carried by its electric lines in Guadalajara during the year 1909. This is an increase of 1,460,000 passengers over the previous year. Plans have been adopted for the construction of important extensions of the system during the present year. The proposed extensions will run to the suburbs and over streets in the outskirts of the city that are not now occupied. The material for a portion of this new work has already arrived.

The Alfred B. Adams Company, of the City of Mexico, have made plans for the erection of a large hydroelectric plant on the Balsas River, near Guerro, Mexico. It is estimated that 60,000 hp can be developed under the concessions already held from the Government. It is proposed to transmit the electric power to the city of Guerrero and to towns and mining camps in this part of the country.

Less Work at Same Pay for Telegraph Operators.

A reduction in the length of their working day from ten to eight hours, without decrease in pay, has been granted to the telegraph operators of the Illinois Central Railroad in the principal relay offices at Chicago, Memphis and New Orleans. This reduction comes indirectly as a result of the recent demand made by the railroad telegraphers for a 10 per cent increase in pay, and was allowed by an arbitration committee which included representatives of both the operators and company. By the terms of the same award operators in the train-despatching offices are granted a decrease from ten to nine hours, and all operators on the system who are required to work ten hours or more a day are to be allowed a 15-day leave-of-absence with full pay. The arbitration board also grants the Order of Railway Telegraphers, with which the Illinois Central operators are affiliated, the right to control as a part of its membership all telephone operators employed in the train-despatching service of the system. The arbitration board consisted of Prof. B. H. Meyer, of the University of Wisconsin, umpire; President I. G. Rawn, of the Monon Railroad, representative for the company, and John A. Newman, of the Order of Railway Telegraphers, for the operators.

Morgan Telephone Deal.

At the taking of testimony last week in the suit brought by the minority stockholders of the United States Telephone Company to set aside the sale of control of the company to J. P. Morgan & Company, details of how the deal was made were brought out. The first witness was Mr. Edward J. Hall, vice-president of the American Telephone & Telegraph Company. He testified that the principal competitors of the American company were the United States, long-distance, company; the Cuyahoga Telephone Company, of Cleveland, a local concern, and the Indianapolis Telephone Company and its allied interests. He said that the American company had determined to acquire control of these properties and had started some negotiations to that end when the decision in the Standard Oil Company case, regarding holding companies, had caused the plan to be abandoned. He said that the first his company knew of the Morgan purchase was the announcement in the newspapers. When Mr. F. H. Goff, of Cleveland, and Mr. James S. Brailey, who between them owned control of the independent companies, offered to sell their interests to the American company, Mr. Hall took the proposition to President Theodore N. Vail. Mr. Vail thought that it would be advisable to buy, but did not think that the present was a good time to go into the absorption of independents and so an arrangement was made by which the stock should be purchased by the banking firm of R. L. Day & Company and held on option, the money for the purchase being loaned to the bankers by the American company. This was done and during the latter part of October and the first of November the American company advanced the money to Day & Company as rapidly as the stock was delivered. The total amount so advanced was $7,280,000, and this amount was repaid to the telephone company on Dec. 9. Mr. Hall said that while Day & Company held the stock for the American company he had tried to form a holding company to take up the option and in this effort he approached Mr. H. P. Davidson, of the firm of J. P. Morgan & Company. After some investigation of the matter Mr. Davidson said that his firm would have nothing to do with the plan. The difficulty of financing a holding company caused the plan to be abandoned. Mr. Davidson is a director in the American Telephone company.

Another witness who testified before the commissioner was Mr. William H. Remick, partner in the firm of R. L. Day & Company. He told much the same story as had been related by Mr. Hall and said that he had first met Messrs. Goff and Brailey in the office of the American Telephone Company. He said that the contract for the deal was drawn up by the attorney of that company. He also said that the first connection he had with the Morgan firm was when Mr. Davidson telephoned him and asked if he could buy the stock. Mr. Remick secured a release of the option held by the American company and then sold the securities to J. P. Morgan & Company for a sum which he said was slightly more than was paid to Messrs. Goff and Brailey. The loan of the telephone company was repaid and the transaction was closed on Dec. 9. The stocks that were transferred to Mr. Morgan were 20,000 shares common and 23,500 shares preferred of the Cuyahoga Telephone Company and 10,300 common and 26,500 preferred shares of the United States Telephone Company.

Mr. Remick also testified that his firm had sold recently $200,000 of bonds of the Mutual Telephone Company, of Huntington, W. Va., to Mr. Edmund W. Wakelee, a State Senator of New Jersey. Mr. Hall had previously said that these bonds were now held by the Southern Bell Company, which is the main subsidiary of the American company in West Virginia and the South.

At the next hearing President Vail, of the American company, will be examined and possibly Mr. J. P. Morgan will be called.

Chicago Sanitary District Hydroelectric Power.

In his recent annual message to the board of trustees of the Sanitary District of Chicago, Mr. Robert R. McCormick, president of the board, gives some facts about the utilization of the electrical energy produced from the water-power of the Chicago Drainage Canal which are of general interest. Mr. McCormick points out that the people of Chicago have already spent $65,000,000 on the Drainage Canal and its appurtenants, and he devotes considerable attention to the relation of the existing works to the proposed deep waterway from the Great Lakes to the Gulf of Mexico. The canal was designed for the purpose of carrying off the sewage of Chicago, together with an authorized flow of 600,000 cu. ft. of water per minute from Lake Michigan. Mr. McCormick speaks of it as the greatest artificial waterway the world has ever seen. As a disposer of sewage the canal has proved its success, but incidentally a water-power was created, and this has been utilized by the building of a generating station at Lockport, Ill., where a fall of about 34 ft. is available. This plant has a present rating of 24,000 kw in six units of equal size. Electricity is generated at 6600 volts and transformed to a line potential of 44,000 volts, and thus transmitted to a terminal station in Chicago, 30 miles distant, whence the electrical energy is transmitted to various substations at 12,000 volts, the distribution being from the substations.

Mr. McCormick has much to say about the development of the water-power which will be available by the construction of the proposed deep waterway from the Drainage Canal at Lockport to the present head of navigation on the Illinois River at Utica. He concludes that portion of his message relating to this particular subject with the following words: "The proposed power plants in the Des Plaines and Illinois Rivers

should, by proper electrical equipment, confer like benefits upon all cities and towns within 100 miles of any power plant. But this can only be done if the State, in its legislation, shall provide for the construction of transmission lines; it will never be done if the power is turned over at the power houses to private corporations."

Referring more particularly to the existing electrical department of the Sanitary District, the president of the board presents some interesting statistics. The following table is given:

Month.	Miles of overhead transmission lines.†	Miles of underground transmission lines.	Maximum load at power-house, kw.	Revenue—Commercial.	Revenue—Public institutions.	Revenue—Total.
Dec., 1907.	6.5	0	100	None	None	None
Dec., 1908.	55.	0	6,800	$6,776.07	*$11,219.64	$17,995.71
Dec., 1909.	110.	37.9	12,700	21,427.07	*16,831.85	38,258.92

* Interest included. † Exclusive of main line.

At the time the message was presented (Jan. 26, 1910) the complete figures of the electrical department for the year 1909 were not at hand, but it was estimated that the net profits for the year were not far from $194,000. These profits have been earned, according to Mr. McCormick, in spite of the fact that electrical energy is furnished by the Sanitary District to the public bodies which have chosen to purchase it at prices approximating 20 per cent of the market price for electricity and 30 per cent of the cost of producing electricity by steam. Municipalities and public institutions take 67.3 per cent of the electricity generated, while they contribute but 43.9 per cent of the money received. The president says that the building up of a commercial business by the Sanitary District has absorbed the greater part of his time, as well as the entire time of many employees of the department. The plant was completed in December, 1907, but it was not until the month of May, 1909, that a profit was made above all the charges which the accountants believe proper. The investment in the plant is nearly $4,000,000.

Mr. McCormick speaks of the strong competition of the Commonwealth Edison Company, and gives an account of the slow expansion of the distribution system. The city of Chicago takes its electricity for street lighting from the Sanitary District, and it has built transmission lines from its various substations to the terminal station of the District at Western Avenue and Thirty-first Street. To some extent these lines parallel those of the Sanitary District itself, and it has been proposed by the trustees of the latter body to buy them from the city and to furnish electricity for street lighting at the municipal substations. By this plan it is contended that the city will be given ready cash wherewith to increase its lighting system, while the Sanitary District, at a cost not greater than the original construction cost, will obtain additional feeders by which to market its surplus of electricity. The trustees believe these circuits could be used for transmitting electrical energy for motors in the daytime, as well as for street lighting at night. Specifically they think that this energy could be used to operate in part, at least, the pumping stations of the city waterworks. Furthermore, the City Hall and County Building, the Criminal Court Building, Public Library, many police stations and Fire Department houses, and perhaps many of the public schools, could be supplied with electricity for lighting by this means. In addition, access could be had to the South Park system, which is the only park system in Chicago that is not now taking electricity from the Sanitary District. This plan is now under advisement by the finance committee of the City Council.

Mr. McCormick has discovered that the question of rates for electric service is complicated in the extreme. His views on this subject will perhaps be of interest. "Nowhere at any time," he says, "has a rate been found which can apply to all kinds of consumers with justice to them and to the producer. It often seems to me that a given flat rate per kilowatt-hour should be adopted and adhered to in contracts for consumers, both large and small, whose hours of consumption are either long or short. But, in endeavoring to establish such a rate, we inevitably find that, on the one hand, the rate will be too high to obtain some consumers whose business would be most profitable, while it would, on the other hand, obtain a great many who must be served at a loss. Arbitrary rules laid down under the maximum-demand system, after all, come nearer to being generally applicable than any others. But even these are most faulty, and justice can apparently only be achieved by treating each case on its merits. And yet the policy of treating each case on its merits opens up a field for unlimited discrimination."

After considering this perplexing outlook, Mr. McCormick advocates as the only possible solution, whether there be competition or monopoly, that a public-service commission be appointed which shall fix rigid schedules which must be strictly adhered to unless a situation shall arise sufficiently far out of the ordinary to warrant the commission in allowing a particular rate. What the increase in commercial business of the District will be during the present year, the president of the board does not venture to say. He remarks, however, that the use of transmission lines now employed exclusively for street lighting will furnish a great opportunity to increase the commercial business of the District. But Mr. McCormick is apprehensive that there is a certainty of keener competition on the part of public-service corporations.

It is interesting to note that the number of contracts for electrical service obtained in 1907 was 6, while 64 were secured in 1908, and 86 in 1909. These contracts are mostly with large consumers, apparently. Mr. McCormick makes the remark that house lighting in Chicago is not a water-power proposition.

Inverted Rotary Converter Patent Litigation.

The United States Circuit Court of Appeals for the New Jersey Circuit has upheld in a recent decision a patent issued June 21, 1898 (No. 606,015), to B. G. Lamme relating to means for the satisfactory operation of the inverted rotary converter—that is to say, of the rotary converter when used to convert direct into alternating current. The opinion states that at the date of the patent the rotary converter operated satisfactory to convert alternating into direct current, but when used to transform direct into alternating current it proved unsatisfactory and developed dangers such as almost to prohibit its use. The court defines the rotary converter as constructed at the date of the patent (1898) as "consisting of a motor and a generator placed side by side on a common shaft and having a common magnetic field; they have also a common winding connected at different points to the bars of the commutator and to the collector rings, respectively, so that when direct current was led into the coils through the commutator, thus driving the machine as a direct-current motor, an alternating current could be taken from the collector rings." The description applies to the ordinary rotary construction with the exception of the reference to "a motor and generator placed side by side on a common shaft."

In the operation of the simple inverted rotary it was found that if the alternating-current circuit carries an inductive load, such, for example, as induction motors, which load changes from time to time, such variations will cause variations in the speed of the converter, which will in turn vary the speed of the motors driven by it. In many cases, for reasons not then known, the rotary would rapidly speed up, in some cases leading to the destruction of the machine. The means offered in the patent in suit to avoid the above trouble consisted in the employment of a small direct-current generator for exciting the field magnet of the rotary, which normally operates to produce an e.m.f. corresponding to a degree of field-magnet excitation very much below saturation, which exciter may be driven either by an alternating-current motor in turn driven by a current supplied by the rotary or directly belted to the rotary. With this arrangement, if the amount of alternating current or inductive load on the rotary changes so that, for example, the rate of alternation decreases, then the exciter

and the motor driving the same will also decrease in speed. This action will decrease the exciting e.m.f. of the rotary; and as the exciter is unsaturated, a small drop in speed will produce a relatively large drop in the e.m.f., which lowering of the exciting e.m.f. will weaken the field of the rotary and effect an increase of its armature speed up to near the normal.

The defense in the suit included the claim of no invention, on the grounds that the elements of the device were old, and that the device was a mere assembling of these elements in a manner which did not involve invention. The Court held, however, that the fact that the electrical world had made no such combination as that of Lamme, notwithstanding the known difficulty existing in the operation of the inverted rotary, is highly suggestive that more than engineering advance of the electrical art was involved in the combination. Furthermore, the opinion states, that, in dealing with electricity, "an invisible and intangible agent, and in itself of different kinds, and when we know that in its different phases it may affect, or be affected by, metals and appliances in different ways and with wholly different results, we must guard against being misled by the mere superficial resemblance of the appliances and machines in connection with it, for from an electrical standpoint the real significance of such appliances lies not in any material or external appearance, but in their working effect under the influence of diverse electrical factors."

Another defense was anticipation in a patent granted to P. O. Keilholtz, which, however, is disposed of on the grounds that the mechanism cited is wholly different electrically, the only thing in common between them being the self use of rotation to control speed along the lines of the well-understood principle of the common steam generator. In the Keilholtz device the magnetic field of the generator was self excited, and was not connected with or affected by the auxiliary exciter, which latter increased or decreased the magnetism of the magnetic field of the motor alone.

The opinion of the court is that the Lamme patent on the inverted rotary is valid. The parties to the suit were the Westinghouse Electric & Manufacturing Company and the Allis-Chalmers Company.

Trackless Trolleys in Austria.

The trackless trolley system in operation near Vienna, which has been noted several times in these columns, is the subject of a report in detail recently made by the United States Consul-General in Vienna, from which the following particulars are gathered:

The system is the invention of Ludwig Stoll, of Vienna, a leading official of the Austrian Daimler Motor Company. Current is taken from the overhead trolley line by flexible cables attached to a head or current collector consisting of a frame with two small grooved wheels on each side. One pair of wheels runs on the positive, the other on the negative wire, and the cable is suspended from the center of the frame, from which point is also suspended a weighted pendulum, which keeps the wheels well pressed down on the wires. The wheels run on ball bearings. The conducting cable can be lengthened to follow the car by two appliances—an upper sliding knot at the pendulum weight, and a cable roller with 10 to 12 yd. of cable, which can be rolled up or let out by a spiral spring. Thus the car is allowed to run on any part of the road, to overtake other carriages, or to turn anywhere, accommodating itself to all kinds of traffic.

When two cars running in opposite directions meet, the drivers interchange trolleys by means of detachable connections, an important advantage over a tram line with one track, on which the loss of time in waiting at passing places is sometimes considerable. The vehicle having this flexible means of taking the current can, it is stated, move as far as 65 ft. away from the wire.

The chassis of the vehicles for transport of passengers or goods is made of pressed steel and supported on the axles by springs. The brakes act on the back wheels. The electrical part comprises a controller of tramway pattern, resistances, and two hub motors of 20 hp each, which form an integral part of the driving wheels themselves on the Lohner-Porsche principle. There are no other mechanical parts of control or transmission. Hardly any lubrication is required, all the parts of the wheels and motors running on ball bearings. Further, the elasticity of the vehicle itself is considerable, as the springs support only the chassis, the body, and the passengers, but no machinery, batteries, or transmission gear, there being none of these mechanical complications. The suspension, therefore, is perfect, and notwithstanding the imperfections of road, gives the impression of moving on rails. Vehicles carrying 6600 lb. and over have rear wheels with iron tires. The cables transmitting the current passes through the interior of the axle. The armature of the motor is fixed by means of keys on the axle itself, and so acts as the hub of the wheel. The rest of the wheel is mounted on ball bearings, and is completely protected from dust. The cover serves to close hermetically the motor, as well as to fix it on the axle. Solid rubber tires are fitted to absorb the inequalities of the road.

The Stoll system is in actual operation at Vienna in connection with the municipal tramways (in the Pötzleinsdorf-Salmannsdorf district); at Weidling, near Vienna; at Gmünd, Lower Austria; at Budweis, Bohemia (opened in November, 1908), and is being installed at Pressburg, Hungary. The last named will have 3.6 miles of line with 4 wires, 6 passenger cars and 1 freight car, the whole to cost about $60,000.

The following are given as being the costs in Vienna of running a car 75 miles daily:

Energy (1 cent per kw-hour)	$0.40 to $0.60
Tires (total load 4.2 tons)	1.50 to 2.00
Wages (driver only, also for tickets)	1.60 to 1.80
Garage	.30 to .40
Taxes, management, insurance	.80 to 1.20
Repairs, painting, renewals of cars and conductors	.60 to .80
Total running costs	$5.20 to $6.80

This figures out 7 to 9 cents per mile. The line is 1⅓ miles long. It passes through narrow streets and around narrow and sharp corners on a continuous steep gradient up and down, the steepest being 10 per cent for a long distance. In order to meet the extraordinary requirements of an intense summer and Sunday traffic, two separate aerial lines are provided to let the cars pass without stopping. One side of the trolley is connected with the conduits of the city tramways, and the other with their rails. At both terminals loops are arranged, so that the cars are continually running round. Four handsomely fitted cars, each for 24 passengers, are doing service on this line.

The Stoll trackless trolley system line at Weidling, near Vienna, is 2.3 miles long and has a tortuous, hilly road, with a gradient of 7 per cent. Three cars, with 21 seats each, were purchased with the idea of conveying 120,000 passengers per annum, whereas 132,000 passengers were carried during four months only, hence two new cars have been ordered. The three cars are doing excellent work, notwithstanding the heavy traffic, 60 to 100 miles being run daily from 5:30 a. m. to midnight; on Sundays 2700 passengers are carried, at fares a little over 4 cents. This can only be done on unbroken runs; the meeting of cars and interchanging of trolley cables needs only 10 seconds and can be done at any point on the way. The mails are carried in a box under the car.

The Stoll line at Gmünd is under municipal control and is running a passenger and postal service between the town of Gmünd and the railway station. This line was originally estimated to carry 24,000 passengers a year, but actually carried during the first six months of the service 44,305 passengers, besides the mails and 1150 sundry packages. The only car provided was in service from 5:30 a. m. until 10 p. m., and made 34 trips, and on certain days (holidays and Sundays) up to 50 trips a day. The total distance covered by the car was 9337 miles, without needing a single repair, and the rubber tires were in excellent condition. The consumption of energy, including lighting of car and garage, was 3034 kw-hours. The average was 7½ passengers per trip, including the driver, making 1320 lb., and, adding the weight of the car, a total average of 6270 lb., per trip.

The total consumption of energy having been 3.030 kw-hours, this gives per car-kilometer 190 watt-hours, or about 65 watt-hours per kilometer-ton on average, including the losses of starting and 6000 turns at the extremities of the line. This average was made during a period which included a long stretch of bad weather, including the heavy falls of snow which occurred during the winter of 1907-8. During the first quarter, when more favorable weather was experienced, the average consumption of energy fell to 54 watt-hours per kilometer-ton. The line from Gmünd to the station is slightly hilly during its entire length, the gradients having an average of 1 to 1½ per cent. The steepest gradient has 4 per cent for over 656 ft. The receipts on this line for the first six months' service amounted to 6000 crowns. According to special agreements with the town and postal service, the fare for passengers was about 1 1/5 to 2 cents, according to the distance, with a maximum at certain hours of about 4 cents. The expenditure for the same period in detail was as follows:

Wages of driver	$184
Sundry insurances, accident and fire	68
Printing	56
Energy, 3030 kw-hours, including lighting of garage, etc	190
Maintenance, overhauling of car and line	92
Grease and oil	5
Total	$595

Some Features of Practical Telephone Service.

Mr. Angus S. Hibbard, vice-president and general manager of the Chicago Telephone Company, was the speaker at the meeting of the Electric Club of Chicago on Feb. 9. His subject was "Telephone Traffic and Problems." He said that the development of the telephone in the 17 years during which he has been connected with the Chicago company has been extremely interesting. In 1893 there were many crudities, and if the men employed in the work at that time could have foreseen the perplexities and intricacies of latter-day telephone development they would have shrunk from the task in dismay. However, the working staff of the company, to which Mr. Hibbard paid a generous tribute, and which now numbers 8100 employees, has developed with the increased burden which has been put upon it, and many of the men engaged in this employment have won high positions in the field as the result of conscientious study and arduous endeavor.

Many standard methods of handling telephone business have been evolved out of the strenuous Chicago conditions resulting from the expansion of an exchange of 8200 telephones in 1893 to one of 210,000 telephones in the city itself in 1910. The working staff is a harmonious organization; in fact, co-operation is everything in telephone service. The traffic, plant and commercial departments must work in harmony or else there is chaos. District technical meetings are held at frequent intervals, and the speaker mentioned incidentally such a meeting attended by 700 employees of the company which he had addressed the preceding evening. There are also technical meetings of smaller groups than those represented by districts.

Referring to the increased cost of living, to which so much attention is paid nowadays, Mr. Hibbard pointed out that the average cost of a telephone in Chicago in 1895 was $126.19 and in 1909, $39.42. Thus the telephone costs, on an average, only one-third what it did 15 years ago, while the cost of other necessities and conveniences has very largely increased. Of course, a part of this decrease is to be attributed to the fact that conditions in the telephone exchange business have changed. For instance, the business man who had one telephone 10 or 15 years ago now has a system of telephones. The telephone company, among its other activities, has found it necessary to study the business necessities of the people it serves.

Mr. Hibbard thinks that the telephone company has the hardest task of all public-service corporations. The principal reason for this is that its customers are inter-dependent. Thus if the service of one customer is out of order it does not affect that customer alone, or at the most a group of customers, as would be the case with a corresponding failure of the electric service, but it affects many others over the entire exchange system. Telephone subscribers use the service on the understanding that they shall have access to all other telephone subscribers. The unit of service is the "unit of everybody," so to speak.

It is a privilege to take part in the telephone service of Chicago, or, indeed, in any public-utility service in that city. In many ways the work is extremely interesting. It requires alertness and constant vigilance to keep up with it. It is a conservative estimate that the telephone exchange will continue to gain 30,000 subscribers a year. Thus at the end of ten years the Chicago exchange will probably have 450,000 telephones, while there will be 600,000 stations in the entire territory covered by the company, which is considerably larger than the area of the city. It is interesting to note that to make a net gain of 30,000 telephones a year the company must install 60,000 instruments, for the ratio is about two ingoing telephones to one taken out. In installing its system the company has dug under 614 miles of streets and has over 600,000 miles of wire buried.

One thing of especial importance and interest has been the devising of equitable rates for service. The speaker mentioned flat, measured and prepayment rates, devoting particular attention to the latter, or nickel service. This service is extremely popular and has grown tremendously. More than one-half of all telephones in Chicago are nickel prepayment telephones. The maintenance of this branch involves a tremendous amount of detail, but apparently the service given is satisfactory to the public.

In speaking of the necessity of forecasting the growth of the city in order to provide adequate telephone plant, Mr. Hibbard made a passing reference to the recent appointment of Mr. Bion J. Arnold as chief engineer of subways in Chicago, saying that the selection was an excellent one which must prove a source of gratification to all having to do with the buried structures in Chicago's streets. The telephone company has a force of men that does nothing else but study the future growth of the city—its trend in extent, character and business possibilities. It is necessary to discount the future in this manner, so that the company may have intelligent guidance in making its investment in ducts for telephone conductors to meet the needs of the future. The day has passed when underground telephone work can be installed for a small number of customers in a certain district and then added to with a slight increase and again disturbed later on, and so on. The company must foresee, as far as possible, what the future development will be through a considerable term of years. This course has been followed, more or less, for the last 16 years, and the speaker remarked that the company has rarely over-guessed the growth and development of the city. Along this line, referring briefly to the question whether telephone monopoly or telephone competition is better for a community, Mr. Hibbard said that he believed that, in the long run, one universal telephone system would be demanded by the public, so that everybody can reach everybody else.

There was a brief discussion. Mr. George H. Lukes, general superintendent of the North Shore Electric Company, asked what was the approximate value of the telephone apparatus placed in the residence of a subscriber. What effect would it have on the rapid expansion of the business mentioned by Mr. Hibbard if the telephone subscriber had to pay for his apparatus, as is the case with the customers of the electric light company?

Mr. Hibbard answered that the investment for individual customers ranges from $18 for the cheapest private-house equipment to perhaps $100 for a business telephone. He said that it is true that there is some inequality in the matter of installing telephones. One man with a handsomely appointed house with hardwood floors will be very particular about the manner in which the telephone wiring is done. In another situation the job may be comparatively inexpensive. Yet no charge is made to the consumer in either case. It would probably be more equitable if subscribers were required to install their own telephone equipment because of these conditions;

nevertheless, the instrument ought always to belong to the company supplying the service, so as to insure uniformity. It is true that it sometimes costs more to install a telephone than the company gets from the resulting service during a period of two or three years.

Mr. Lukes remarked that the telephone company seemed to get more customers than the electric-light company in the suburban districts, and he wondered if it was not because there is no initial expense in the case of the telephone user. In answer to a question from Mr. Hibbard, he said that a rough approximation of the cost of wiring a customer's house for electric service in the suburban territory around Chicago would be $100. Mr. Hibbard thought that very likely the telephone company had an advantage over the electric-light company by making no charge for installing the service. Mr. R. S. Mitten and others also took part in the discussion.

Ohio Telephone Legislation.

A bill introduced into the Ohio House of Representatives on Feb. 1, which provides for a possible consolidation of the competing telephone lines in the State, is being opposed on the ground that, if enacted into a law, it would make the merger of the independent and Bell companies easy. The bill also repeals the Valentine anti-trust law so far as it applies to telephone companies. A general understanding of the bill was brought to the public through a hearing before the committee on railroads and telegraphs of the House.

The bill provides that where two or more competing companies are operating lines which intersect or parallel each other on a public highway, or when they are engaged in the telephone business in the same municipality they may connect their wires so that the patrons of one exchange may use the wires of the other in order to reach persons desired. It is claimed that there is a joker in the bill, because of the fact that immediately following the statement of what the companies *may* do occurs the assertion that after the connections are made the plants *shall* be owned, operated and maintained in the manner and upon the terms agreed upon between the boards of directors of the respective companies. Consolidation of plants is authorized as provided in the laws governing the consolidation of railroads, but these laws offer no such favorable terms as the other portion of the bill would allow.

Automatic Telephone Apparatus.

A paper, entitled "A Modern Automatic Telephone Apparatus," was presented by Mr. Lee W. Campbell at a meeting of the American Institute of Electrical Engineers held Feb. 11 under the auspices of the telegraphy and telephony committee of the institute.

The author set forth the advantages of the automatic telephony over the manual system. Confining himself to the discussion of a single system, which is in extensive use, he described in great detail the theory of operation, showing the steps in the process of connecting one subscriber with another. The construction of the apparatus was touched upon sufficiently to explain the method of making connections without going into features of its design.

There are three classes of switches which take part in making every connection between subscribers, namely: Line switches, selector switches, and connector switches. Every subscriber's line terminates in a line switch, which is held automatically in readiness to connect with a free selector switch, which receives the signals sent out by the calling device and makes connection with the proper connector switch, which then completes the circuit to the called line. Each connector switch serves 100 lines and makes connections corresponding to the last two digits in the number called. It is impossible for one such switch to handle all the calls for the 100 lines to which it has access, and, therefore, it is usual to provide 10 connector switches for each 100 lines.

Originally there was one selector switch for every line, but the line switch, which is a much cheaper device, makes it possible to reduce the number of selector switches to 18 for each 100 lines without in any way increasing the time required to make a call. The time switch is so arranged as to be always posed ready for connection to an idle selector, and the removal of the receiver makes the connection. As soon as a selector has been connected to a line, all other line switches served by that selector are automatically moved along to a position in readiness for connection to the next selector. In an exchange of less than 1000 subscribers the selectors connect directly to the connectors. For instance, in calling 649, the line switch connects to the first idle selector when the receiver is taken off the hook, then the selector picks an idle connector in the 600 group and the connector completes the connection to 49. An exchange of 10,000 lines is handled by introducing a second selector switch, one group for each digit in the fourth or thousands' place. Then the first selector picks a second selector in the group corresponding to the fourth figure in the called number, and this one selects the connector in the usual way. In the same way, by adding groups of third selectors, the size of the exchange may be increased to 100,000 lines ,and so on.

Experience showed that in large exchanges the number of first selectors was considerably greater than needed, and, therefore, further economy has been made by introducing a second line switch between the first line switch and the first selector, thus putting each group of 100 first selectors at the service of 2000 or more lines.

One of the most important advantages of the automatic system is the great saving in wire, and as the system becomes larger and is spread over more territory this advantage increases in importance. This saving in wire is accomplished by grouping the subscribers into districts and running the lines to a centrally located district station, where they are connected to the line switches and the connection banks of the connector switches. All of the selector switches are placed in the main central office, so that all long runs may be trunked and the wires used at the best load factor. Experience indicates that 23 wires between the district station and the main station are sufficient for 100 lines, including wires for supervision of the apparatus.

In discussing the paper, Mr. Ralph W. Pope recalled an early experience with the Strowger system when he was chairman of the committee of telegraphy and signalling at the World's Fair in Chicago in 1893, where the system did not succeed in getting an award. At that time it did not look like a formidable competitor of the manual system. As a contrast to his early experience, he related incidents of his recent tour through the West, where there are a number of large cities equipped with the automatic system. The users, apparently, were very enthusiastic in its praise. Especially were they pleased with the despatch and the reliability of the service. A thing that impressed many was the fact that practically all repairs were made before the actual trouble occurred; it being the practice to keep close watch of the system and immediately ascertain the cause of every little irregularity in the operation of the machines. It seems that a trained man readily detects a fault by the sound of the switches and can locate and repair the circuit before any trouble occurs.

Mr. William Maver, chairman of the committee, praised the modesty of the author, who presented his apparatus as though it might have been on trial, while, as a matter of fact, over 250,000 subscribers in the United States are now using them. At a matter of historical interest, Mr. Maver then described an early automatic system of Callendar, which was remarkable for the complications and ingeniousness of its operating principle.

Mr. E. A. Mellinger, in a written communication, enlarged upon Mr. Cambell's statement regarding the special suitability of the automatic system to large cities, and stated that the exact dividing line between the automatic and manual system, when figured on a purely economic basis, occurred with exchanges of about 500 subscribers. For exchanges with a less number of subscribers the automatic cannot compete with the

manual system unless its desirable operating characteristics are taken into account to balance its extra cost.

Mr. H. W. Pope raised the question of maintenance, stating that he believed this to be a serious obstacle to the use of the automatic system on a very large scale. In discussing this point, Mr. Cambell stated that the maintenance labor, being of higher class than that employed in manual systems, costs more, while the cost of maintenance material is considerably less. He ventured the assertion that the cost of new cords alone in the manual system would more than cover the total cost of materials used in an automatic system of the same size. The decreased operating cost due to the absence of manual operators more than offsets the extra first cost of the plant and any probable increase in the maintenance. An automatic plant which has been in operation for 10 years in Fall River, Mass., shows little or no wear, and is operating better to-day than when installed, although the apparatus is completely out of date.

Massachusetts Legislative Notes.

The committee on metropolitan affairs of the Massachusetts Legislature gave a public hearing on Feb. 9 upon the portion of the report of the Boston Finance Commission which recommends the bonding of public utility corporations obliged to open the public streets, and also includes a charge for each opening. The Massachusetts Electric Lighting Association and the gas interests opposed the plan on the score of expense. Last year the Edison Electric Illuminating Company, of Boston, took out 1990 permits to open the streets, with four openings to each permit.

The committee on public lighting gave a hearing recently upon the bills providing for municipal lighting plants upon a majority vote of a City Council and permitting municipalities to go into the lighting business without the necessity of purchasing the plants of existing companies in the territory. The Massachusetts Electric Lighting Association opposed both bills. It was shown that the hazardous and wasteful experiment of a municipal lighting plant in the city of Boston had recently been nipped in the bud by the wise provisions of the existing law, and within 24 hours the committee reported leave to withdraw the bill. Regarding the bill which does not require a city or town to purchase an existing central station before undertaking municipal ownership or operation, it was said that if this should be passed it would utterly reverse policies which have been found excellent in Massachusetts for more than 20 years, permitting unbridled competition without compensation for business attacked. It was further stated that the superior management of the private corporations would unquestionably drive the municipal plants to the wall if competition were attempted, apart from the burdens thus placed upon the community.

An important hint of the general line of future development of the New York, New Haven & Hartford Railroad in the field of public-utility operation was given at a hearing before the committee on railroads recently by Vice-President T. E. Byrnes. He stated that within a few years the great traction roads of the country will all be run by electricity, and that the railroads will supply electrical energy in the form of a by-product to be used for lighting and power service in the towns and cities through which the lines pass. The railroads will derive benefit chiefly from the ability to supply energy at hours when the train service is not at its maximum. Mr. Byrnes said that the electrification of the suburban lines at Boston by the New Haven company is certain to come. He stated that if Massachusetts would lend the company a helping hand the latter would expend $50,000,000 in improvements on the road within the next ten years, and all within the State. Water, gas and electric-light companies have come to the New Haven incidentally, and it would be a great loss if the company should be deprived of its public utilities. In closing, Mr. Byrnes said that it was his opinion that within 15 years the New Haven company would own the water powers along its lines and supply local lighting and power service on a large scale.

Pending Legislation in Illinois.

It is proposed to apply the commission form of government, such as is in force in Des Moines and other cities, to cities in Illinois having less than 200,000 population. The Senate of the State Legislature has passed a bill to this effect which is now pending in the House. Amendments to the bill have been proposed in both houses, and if the measure becomes a law it will probably be as the result of a conference. It is proposed that five commissioners be elected by the voters to have all the powers of government and to do away with the Mayor and City Council. One of these commissioners would have charge of public service and public-service corporations, and so the public utilities of the State outside of Chicago are considerably interested in the fate of the bill. The commissioners, under the proposed law, would exercise great powers, and it is proposed that the voters have the right to recall any commissioner who abused his authority. If a petition is signed by a certain proportion of the voters, an election may be held to determine whether an offending commissioner shall be recalled, and, if so, who his successor shall be. It is proposed that the adoption of the commission form of government shall be optional with the cities coming under the provisions of the proposed law. The bill contains numerous proposals affecting public-service companies, but it will probably be amended in many particulars before final passage, if, indeed, it should reach that stage.

Senator Ettelson, of Chicago, has introduced a bill in the State Senate which authorizes Chicago to construct and operate a subway.

The Schmitt waterway bill has passed the Senate and is pending in the House. This is the bill which is the outgrowth of the constitutional amendment previously sanctioned by the voters permitting the issuing of $20,000,000 in bonds to build a waterway, commonly known as the "deep waterway," from Lockport, Ill., on the Chicago Drainage Canal, to the head of navigation on the Illinois River at Utica, Ill. The Schmitt bill provides for a commission of seven members to proceed to build the waterway and also to erect hydroelectric works to develop the water-power incidentally created. Gov. Deneen is actively favoring this project, but is meeting much opposition. Allied with the waterway proposition is the proposal that the old Illinois and Michigan Canal be connected with the Chicago Drainage Canal at Lockport by a suitable lock, permitting navigation between the two canals for boats of light draft. The connection would be a very short one and would cost not more than $100,000, it is said. The Sanitary District, operating the Drainage Canal, would be required to defray the expense. A bill to carry this connection into effect has passed the Senate.

Underground Wiring Hearing in Montpelier, Vt.

The Public Service Commission of Vermont held a hearing last week in Montpelier on the matter of placing the electric light and power wires of that city underground. Mr. Frank C. Sargent, engineer of the commission, in a report on the subject said that he considered it neither necessary nor desirable to place underground the wiring of a city of the size of Montpelier, and the commissioners in their decision accepted this view. He did not favor running high and low-tension wires on the same pole, and suggested that the three electrical companies should use pole lines in common. Reference in the hearing was made to the fact that Montpelier has three competing light and power and two telephone companies.

In commenting on statements made as to the unsatisfactory condition of the plants and service, Mr. W. H. Blood, ex-president of the National Electric Light Association, said that, while there were points in which the local companies were deficient, he believed the trouble was largely an inherited one, due to the number of companies involved, none of which was doing a highly profitable business; he felt that the low profits had hindered them from keeping up their lines as they other-

wise would have done, and thought that one company would have done the work much better.

During the entire hearing the matter of placing the wires underground was not seriously considered, as it was shown that such an action would necessarily result in an increase of rates that would be very severe on the consumers. Mr. Sargent did not recommend it in his report, but urged the joint use of the poles as far as possible, in which view Mr. Blood coincided. Consolidated Lighting Company and Vermont Power & Lighting Company placed on the stand Mr. C. O. Lenz, an expert in underground electrical work, whose testimony showed that even to put the wires underground in the business section of the city would necessarily result in an increase of 52 per cent over the rates now charged, and this for the expense of the company alone, not to mention the expense to the consumers of having their interior wiring changed to conform to the new system. It was also shown that such a plan would keep the streets dug up for several months.

New York Public Service Commission News.

At an informal dinner given by Chairman Willcox, of the Public Service Commission, to Mayor Gaynor last week, at which all of the commissioners and members of the Board of Estimate were present, the entire question of rapid transit development in New York City was discussed. While no definite statement was given out, it is understood that there was a thorough agreement as to plans and a unanimous expression that the work of building more subways must be pushed with all possible vigor. It is said that steps will be taken at once to get the Broadway-Lexington Avenue project started.

At a further hearing, last week, into the operation of the subway the commission was informed by General Manager Hedley, of the Interborough Rapid Transit Company, that the contracts for the cars which the commission ordered to be delivered last fall were not signed until after the date at which delivery was desired. There was no definite promise as to when subway conditions would be improved, although it is stated that work has already begun on the lengthening of the platforms of the stations.

The incorporators of the Manhattan Bridge Three-Cent Line made formal application last week to the Public Service Commission for a franchise to operate their line across the new bridge, through Canal Street, in Manhattan, and Flatbush Avenue, in Brooklyn. The incorporators are prominent business men of Brooklyn. The application was opposed by attorneys representing the Brooklyn Rapid Transit Company and the Metropolitan Street Railway Company.

The Public Service Commission, Second District, will hold a hearing next week upon the application of the Syracuse Lighting Company for authority to issue $354,000 par value, 6 per cent, 10-year extension and improvement bonds. The company proposes to make extensions in its gas department, the cost of which will be $147,933, and to its electrical department to the amount of $196,795; and on the joint petition of the Westchester Street Railroad Company and the New York, New Haven & Hartford Railroad Company for an order authorizing the Westchester Street Railroad Company to issue to the New York, New Haven & Hartford Railroad Company stock to the amount of $865,362.31, for consent to the mortgage of its property and franchises to secure the payment of an issue of bonds not to exceed in the aggregate $2,000,000, and for authorization of the issue and sale of bonds to be secured by this mortgage, and for an order authorizing the New York, New Haven & Hartford Railroad Company to acquire, take and hold all of the capital stock of the Westchester Street Railroad Company at any time authorized to be issued by the commission.

The commission has authorized the Cliff Electrical Distributing Company, of Niagara Falls, to exercise rights, privileges and franchises acquired by the Niagara Falls Hydraulic Power & Manufacturing Company; also to increase its authorized capital stock from $25,000 to $500,000. The proceeds of the stock and bonds are to be used in the payment for the transfer to it by the Hydraulic Power & Manufacturing Company of all the property rights and franchises referred to, the purchase price to be paid by the Cliff company to be $750,000. The commission has also approved the form of mortgage submitted by the Cliff company to secure the payment of its 30-year, 5 per cent gold bonds to the aggregate amount of $1,500,000. Provision is made in the order that nothing contained therein shall authorize the issue of any stock or bonds except as above mentioned, that all future or other issues of stock or bonds can be made only after the authorization of the commission. This order provides for the segregation of the affairs of the Niagara Falls Hydraulic Power & Manufacturing Company, so that such matters which relate to public service will be taken care of under the Cliff company organization, and other matters not relating to public service shall continue to be administered by the Hydraulic Power & Manufacturing Company. Whatever rights the public has under the parent company are preserved under the Cliff company's authorization.

Of a total of 6316 tests of electric meters reported by the New York Public Service Commission in December, 1909, 551, or 8.72 per cent, were fast; 4701, or 74.43 per cent, were accurate, and 1064, or 16.85 per cent, were slow.

The commission has received a petition from the Niagara & Erie Power Company for authority to issue its stock and $1,250,000 5 per cent 30-year gold bonds. The authorized capital stock of the petitioner is $100,000. The company also asks for permission to have transferred to it certain property and franchises of the Niagara, Lockport & Ontario Power Company and the Buffalo & Lake Erie Traction Company, and for permission to begin construction and to exercise franchise. Also the application of the Buffalo & Lake Erie Traction Company and the Niagara, Lockport & Ontario Power Company for consent to transfer to the Niagara & Erie Power Company certain capital stock, franchise and other property. The Niagara & Erie Power Company propose to acquire, own and operate an electrical transmission and distributive system commencing at Gardenville, Erie County, and extending through the counties of Erie and Chautauqua, N. Y., and Erie County, Pa. It is stated in the petition that the Niagara, Lockport & Ontario Power Company and the Buffalo & Lake Erie Traction Company desire to transfer the property, contracts and franchises for the reason that the Niagara, Lockport & Ontario Power Company owns and operates two high-tension transmission lines from the Niagara River over private rights-of-way in the city of Syracuse, and a large portion of the electrical energy transmitted by it is sold and delivered to other electrical companies which sell and distribute the same to the customer. The character of service in the business of Niagara, Lockport & Ontario Power Company renders it undesirable for that company to engage in distribution of its energy to the small consumer or in the operation of low-voltage distributing systems. It is deemed advisable that the company should confine itself to the business of high-tension transmission of electric energy and selling and delivering same in large blocks, and should in no wise engage in low-voltage transmission of electric energy and retailing of the same. A substation is maintained at Gardenville for the reason that there is no company engaged in the transmission and distribution of electric energy in the territory to which the company desires to sell its electric energy for distribution. The Buffalo & Lake Erie Traction Company has considerable surplus capacity in its transmission line extending from Athol Springs to West Portland over and above the needs of its business, and unless this capacity is utilized for consumers of power, a considerable waste and loss will result. The Traction Company purchases energy from Niagara, Lockport & Ontario Power Company at Athol Springs for transmission over its high-tension line, which is to be extended from its present terminus at West Portland to the city of Erie, so that the whole railroad system will be operated by the Niagara, Lockport & Ontario Power Company energy. The power available for the purpose will be thereby materially increased. The Traction Company does not desire to engage

in the sale and distribution of electrical energy to consumers, and it is therefore deemed advisable to transfer the business of both companies, so far as distribution to consumers is concerned, to the Niagara & Erie Power Company, which has been organized for that purpose.

Pennsylvania Commission Telephone Decision.

The Pennsylvania Railroad Commission has ruled against exclusive contracts in the exchange of telephone traffic. The decision was made on a complaint of the Consolidated Telephone Companies of Pennsylvania against an exclusive contract between the Bell Telephone Company and the Slate Belt Telephone Company, of Slatington, Pa., and is the first to be given by the commission in a telephone case. The Slate Belt and Consolidated formerly had an agreement, but later a contract was made between the former and the Bell, which, the complaint alleged, prevented connections with any company except the Bell. In the decision the commission says that the convenience of the patrons would be best served if the lines of all telephone companies were connected and each subscriber of every company thus furnished the facility for telephone service to all points on all lines from his own telephone, and not be compelled, as at present, to maintain a number of telephones if he desires general service. The exclusive connection contract is declared to be illegal and invalid, and plainly violative of the oft-declared policy of the State that all public-service corporations shall not discriminate in their service or charges, and shall connect and interchange business with all similar companies.

Wisconsin Rate Commission News.

In a recent decision the Wisconsin Railroad Commission has ordered the Milwaukee Electric Railway & Lighting Company to restore the service to Lake Park, which was discontinued in June, 1909. Lake Park, unlike the numerous purely sectional parks of the city, is extensively patronized by the residents of the entire city on account of its superior natural attractions.

Previous to June, 1909, the railway company operated its cars on an eight-minute schedule direct to the park. But for the purpose of unifying its system by running all cars on the loop system, the routing on this line was changed and the direct service to the park discontinued. Under the new system those who desired to visit the park were required to walk from five to six blocks. Furthermore, it was possible under the old system to reach the park from any part of the city with but one transfer, whereas after the change this was not possible.

The residents along the original route claimed that the discontinuance of the Lake Park service had reduced the value of real estate in that section, besides causing them great inconvenience. But, with regard to these contentions, the Commission held that no "vested rights exist which may be urged by citizens to resist the discontinuance of any street railway service on any line when the change would be more beneficial to the general public." But for the public good the park should be readily accessible from all parts of the city, at least during certain periods of the year. Consequently, the Commission ordered the Milwaukee Electric Railway & Lighting Company to operate cars directly into Lake Park at intervals of not to exceed eight minutes between the hours of 9 a. m. and 9 p. m. from June 1 to Sept. 30, inclusive.

The Commission has authorized the issue of $200,000 worth of stock by the Red Cedar Valley Electric Company. This issue is to consist of 2000 shares of par value $100 each, and is to be sold for the purpose of supplying the said hydroelectric company with funds to pay for the construction and equipment of an electric light and heating plant in the city of Rice Lake, Wis.

It has been found necessary to exempt a number of the small electric-light companies from the rule requiring the testing of all meters in service. In those plants which operate from dusk until midnight it is impracticable to live up to the rule, and the Commission has allowed the tests to be made at the station.

The Statistical Department has shown by data submitted for the annual report that during the year ending June 30, 1909, there have been incorporated 40 electric utilities, with a total capitalization of $5,013,000; 4 gas utilities, with a capital of $140,000; 4 water companies, with a capital of $263,500; 93 telephone utilities, with a capital of $377,935, and 3 electric railways, with a capital of $390,000.

Massachusetts Commission News.

The Massachusetts Railroad Commission has issued a finding favorable to the company in the petition of citizens of Hamilton for a reduction of certain through fares on the Gloucester division of the Boston & Northern Street Railway Company. The petitioners desired the establishment of a 5-cent fare between Hamilton and Essex, Hamilton and Ipswich, and Hamilton to Cabot Street, Beverly. The board finds no sufficient reason for a reduction in these through fares, but recommends the establishment of a 5-cent fare, also desired by the petitioners, upon the line within the limits of the town of Hamilton. The commission has also issued a finding on the petition of the Selectmen of Fairhaven relative to service on the Union Street Railway Company's New Bedford-Fairhaven line. The board finds that, with the exception of certain cars to which the attention of the company was called and upon which repairs have been set in motion, the equipment is in good condition. The board points out, in conclusion, that the existence of a grade crossing and the operation of a drawbridge between the two municipalities are factors that will at times disarrange the operating schedule.

Hearings have been closed on the petition of residents of Salem for a reduction in the noise of operation of the cars of the Boston & Northern Street Railway Company on the Essex Street line. At the final hearing the company showed that it would rebuild the track in the coming spring, and stated that it had expended $1,063,000 for improvements in the Salem division during the past six years.

The Massachusetts Gas and Electric Light Commission gave a hearing recently upon a petition of the Selectmen of Leominster in regard to the street-lighting service furnished the town by the Leominster Electric Light & Power Company. The petitioners were represented by Mr. Alton D. Adams, Worcester, and the company by its president, Mr. Alfred Clarke, Boston. For the petitioners, Mr. Adams stated that complaint is entered against the quality of the present arc and incandescent lamps in Leominster as much inferior in efficiency and illuminating qualities to tungsten lamps; that the size of lamps which the company proposes to furnish and the rates offered (16 cents per kw-hour) are objectionable; that the town desires to have all the present arc and incandescent lamps replaced by tungsten lamps of from 60 to 80 candle-power, furnished, erected, maintained and operated by the company. Enameled radial wave reflectors are desired, and the town wishes to specify lamp locations and to obtain rates from the commission for the supply and operation of these lamps without reducing the rate of annual gross income of the company from street lighting.

For the company, President Clarke stated that he considered it unwise to engage in a tungsten-lamp substitution except on the basis offered the town, viz., that the company would change over the present carbon filament lamps to tungstens, and that it would substitute a given number of all-night arc lamps with a given number of tungstens in order to demonstrate fairly to the company and the town the availability and respective economies of the tungsten lamp for street lighting. If the town desires to experiment with 100-watt tungsten lamps, the company stands ready to remove all its arc lamps and fixtures and substitute on its present lines and poles such brackets, regulators and sockets as the town may require, furnishing energy at the regular rate of 16 cents per kw-hour, the town to furnish its own lamps. Mr. Clarke said that the enclosed arc lamps furnished the town three or four years ago have

been successful and generally satisfactory, and were put in at a cost of $7,000 to the company. The town now desires to confiscate this property and put in a relatively untried system. The incidentals and contingencies are serious in the conduct of an electric-light company. Mr. Clarke urged that there are few street-lighting contracts which are profitable to the company, or only slightly profitable. There are very few street-lighting contracts but which have to be paid for in part by the electric consumer, and the taxpayer goes free. Chairman Barber stated that the board believes, in the interest of the town and the company, that negotiations may well go forward pending the continuation of the hearing, and said that the board will be extremely reluctant to attempt to instruct the town as to what particular kind of lighting it should have. The hearing was continued.

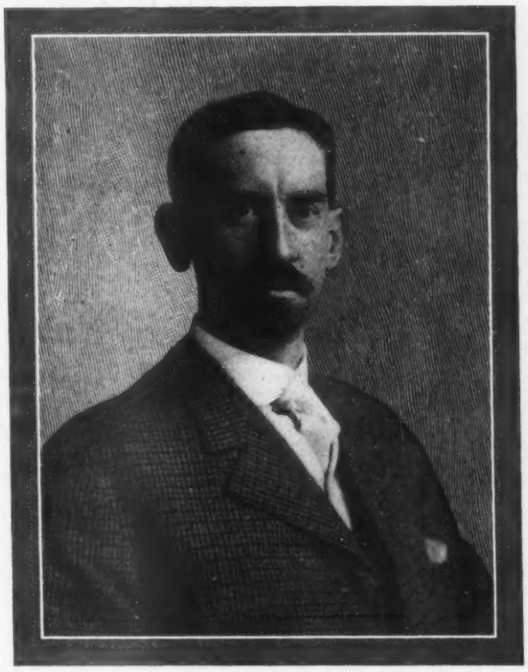
A hearing was given by the Gas and Electric Light Commission on Feb. 14 upon the petition of the Edison Electric Illuminating Company, of Boston, for authority to issue new stock to the amount of $60,000 for purchasing the Lexington Gas & Electric Company's electrical property and business. The company was represented by its president, Mr. C. L. Edgar, and its counsel, Mr. E. W. Burdett. Mr. Burdett stated that the electric and gas plant and business of the property is worth in total assets $122,766, with total liabilities of $105,786. The net payment of the Edison Company for the tangible property is $121,829. Not over 600 shares of new stock are to be issued. The gas property is to be sold to Arthur E. Childs, of the Massachusetts Lighting Companies. Mr. Burdett stated that the plan is merely an extension of the Edison Company's program of establishing its service in various suburban towns where a profitable business may be handled. Edison prices are now in effect in Lexington and have been in force since the lines of the company reached the town. The company desires to eliminate the expense of maintaining a separate organization in the local field. President Edgar stated that the company's plan is to sell the gas end of the business and to establish Edison prices and service in the field in every particular. A principal reason for desiring to enter Lexington was the recent contract with the Boston Suburban Electric Companies for the supply of power to the latter for electric railway operation, the latter organization having a power plant in the town which can be used as a distributing center.

AMERICAN ELECTRICAL ENGINEERS—V.

W. S. Murray.

William Spencer Murray was born Aug. 4, 1873, at the United States Naval Academy, Annapolis, Md., where his father, Pay Director James D. Murray, U. S. N., was at the time stationed. After a course of study at St. John's College, Annapolis, he entered Lehigh University and was graduated from its engineering course in 1895 with the degree of Electrical Engineer. Soon after graduation he entered the employ of the Westinghouse Electric & Manufacturing Company, at first being engaged in the manufacturing and later in the engineering department. In 1898 he joined the district engineering staff of the New England office of the same company, and in the following three years had an extensive experience in the design and construction of high-tension alternating-current plants. In 1901 Mr. Murray resigned from the Westinghouse company to open an office in Boston as consulting electrical engineer. His initial engagements were on the basis of yearly retainers from manufacturing and other corporations, reserving a portion of his time for examinations and reports on electrical properties and investments. Among his clients under this arrangement were the International Paper Company, the S. D. Warren Company (paper manufacturers) and the Atlantic Shore Line Railroad. Mr. Murray's work during this period dealt largely with the subjects of alternating-current generation and transmission, while that for the International Paper Company, with many mills scattered over New England and New York, involved particularly interesting and varied problems.

The special nature of Mr. Murray's engagements enabled him to take the initiative in many new developments, and a favorite pursuit was the analysis of conditions pointing to the future extension of electrical applications. The announcement of a practicable alternating-current railway motor was in particular received by him with the keenest interest, and he utilized every opportunity to acquaint himself fully with all the practical details of this development. When the New York, New Haven & Hartford Railroad decided to electrify its New York division, Mr. Murray was approached with a view to his appointment as electrical engineer of the company, which invitation he finally accepted and entered the employ of the railroad in April, 1905, with headquarters at the general offices at New Haven. His acquaintance with single-phase development enabled him to take a singularly broad view of the electrification problem, including its future scope and exactions. An exhaustive analysis and comparison of electric railway systems led him finally to the conclusion that the single-phase system possessed the greatest merit for the proposed electrification, and his recommendation



Mr. W. S. Murray.

in its favor was adopted. The first commercial service of this noteworthy installation was between New Rochelle and New York in July, 1907. While some difficulties in operation were initially encountered, these were merely incident to a first application on a huge scale of a system previously only operated for a short time on a minor scale, and the final outcome has abundantly justified Mr. Murray's original confidence, which remained unshaken under all trials.

Mr. Murray is a member of the American Institute of Electrical Engineers and one of the managers of that body; member of the Engineers' Club of New York, and of the Graduates' Club of New Haven. In December, 1908, he presented a paper before the American Institute of Electrical Engineers giving an account in minute detail of the engineering difficulties met with during the first months of electrical operation on the New York, New Haven & Hartford Railroad, and showing how these had been gradually eliminated. The paper was unusually frank and independent in its statements, in this respect typifying the broad and liberal attitude characteristic of the author toward engineering questions, and it forms, together with the lengthy discussion which followed its presentation, the most valuable contribution thus far made to the subject of the alternating-current single-phase railway.

CURRENT NEWS AND NOTES

Montana Radium.—Reports from Helena, Mont., state that a vein 15 in. in thickness containing much radium, as well as gold and sapphires, has been discovered near Leonia.

Wireless Telephony in Flight.—During a recent flight in a biplane at Fresno, Cal., the operator kept in communication with the earth, it is reported, while several hundred feet in the air, by means of wireless telephony.

A Correction.—In the letter by Dr. de Forest in the issue of last week on the subject of wireless regulation, the formula included should have been $\gamma = \log \frac{F}{F'}$, and not the simpler relation printed.

Valuation of Canadian Water-Powers.—The Commission for the Conservation of Natural Resources of Canada has appointed Mr. Lee Denis, chief engineer of the Quebec Railway, Light & Power Company, to be electrical engineer of the commission and report upon the value of water-powers throughout the country. Mr. Denis is a graduate of McGill and a brother of the chief of the Department of Mines for Quebec Province.

Heating Value of Gas.—In a recent conference with the New York Public Service Commissions, in which practically every gas company of the State was represented, the proposition of the commissions to establish a new standard for the measurement of gas, by which the gas supply shall conform to heating power requirements instead of illuminating requirements, as at present, met with somewhat reluctant approval by the companies.

New York City Meter Tests.—Of 85 electric meters tested upon complaint by the New York City Public Service Commission three were too fast, eight too slow and 74 within the limit allowed, namely, 4 per cent. Of the 533 gas meters tested upon complaint 264 were too fast and only 37 too slow. The comparative percentages of fast and slow meters are thus, respectively, 2.5 and 9.4 for electric meters and 49.5 and 6.9 for gas meters.

Engineering Society of Wisconsin.—The second annual meeting of the Engineering Society of Wisconsin will be held at Milwaukee Feb. 23-25. Among the papers to be presented are the following: "Depreciation Feature of Valuation Work," by Mr. N. P. Curtis; "Hydroelectric Power Transmission," by Mr. M. H. Collbohm; "Protection of Telephone Lines from High-Potential Circuits," by Mr. W. R. Govern. There will be a report by the committee on electrical engineering.

A. I. E. E. Dinner.—The speakers at the annual dinner of the American Institute of Electrical Engineers, to be held at Hotel Astor, New York, on Feb. 24, will be Dr. John H. Finley, Prof. Elihu Thomson and Messrs. L. B. Stillwell, Samuel Insull and T. C. Martin. Mr. Martin will act as toastmaster. Dr. Finley will speak on "Education and Invention" and Mr. Insull on "Meritorious Achievement in Electrical Engineering." The presentation of the Edison medal to Prof. Thomson will be made by President Stillwell.

Baltimore Sons of Jove.—The Baltimore Section of the Sons of Jove held an enthusiastic meeting at the Eutaw House on the evening of Feb. 10, at which 23 electrical contractors were initiated into the order and the affair was a brilliant success. The officers who were elected for the ensuing year are as follows: Maryland Statesman, Mr. Herman Samuels; Jupiter, Mr. S. B. Prather; Neptune, Mr. Douglas Burnett; Pluto, Mr. J. W. Huey; Mercury, Mr. Joseph B. Dreish; Hercules, Mr. William Bucksbaum; Mars, Mr. William S. Samuels; Apollo, Mr. A. D. Spenser, and Avernim, Mr. J. J. Smith. A dinner followed the meeting.

A Woman Electrical Engineer.—Fraulein Anna Heinrichsdorff has been granted the electrical engineer's diploma of the Berlin Polytechnic Institute The mark "excellent" was given her in every branch of the examination. She is a Moscow woman and the first of her sex to receive an engineer's diploma in Germany. The engineering staff of one of the large American electrical manufacturing companies includes an electrical engineer of the fair sex, and a young woman several years ago conducted an electrical contracting business in New York State.

N. E. L. A. Lightning-Protection Committee.—The committee of the National Electric Light Association on protection from lightning and other static disturbances, of which Mr. Bryce E. Morrow, 82 State Street, Albany, N. Y., is chairman, has started an investigation of the subject committed to it in order to obtain data for its report at the St. Louis convention. All members of the association are requested to communicate their experience and views on the subject, and to facilitate reporting a series of 27 questions has been formulated. The questions are under five heads, as follows: Generating stations (7); substations (3); transmission lines (7); distributing lines (7); general (3).

Chicago Electric Club Committees.—The Electric Club of Chicago is meeting temporarily in the Green Room of the Kuntz-Remmler restaurant, 303 Wabash Avenue. Committees for 1910 have been appointed as follows: House, Messrs. A. A. Gray, chairman; W. R. Bonham, H. M. Frantz, S. M. McFedries; membership, R. S. Mitten, chairman; P. R. Boole, Paul Cratty, H. S. Greene, H. G. Hafner, J. M. Lenz, George H. Lounsbery, H. B. Otis, R. L. Wildauer, Max W. Zabel; entertainment, George H. Porter, chairman; J. M. Schilling, W. S. Taussig, R. M. Van Vleet; finance, E. R. Rockwell, chairman; A. B. Conover, John F. Gilchrist, G. A. E. Kohler, E. W. Lloyd, J. G. Pomeroy. The committee on speakers has not been announced.

A 1020-Mile Trolley Ride.—After traveling 1068 miles, all but 48 miles of which was covered on electric railways, Mr. A. J. Littlejohn reached Chicago on Feb. 8 from Syracuse, N. Y., on the first lap of a trip by trolley which he is undertaking to St. Louis, Mo., and return. The 48-mile interval bridged by steam lies between Kalamazoo and Niles, Mich. However, surveys for a proposed electric railway connecting these points by way of Dowagiac and Paw Paw have already been made, so that it will eventually be possible to make the entire trip by electric traction. Mr. Littlejohn reports 40 hours as the actual traveling time required to cover the 1068 miles—an average sustained speed of about 25 miles per hour. The trip was planned by the Beebe system of electric railways in New York State to show the utility of the trolley for long-distance journeys.

Telephonic Delivery of Letters.—An arrangement has been made by the British Post Office by which letters posted in the country on Saturdays can be delivered in London by telephone on Sundays. When it is desired to have the contents of the letter telephoned on Sunday it must be inclosed in an envelope addressed to the Central Telegraph Office in London, and a broad line marked across the envelope from top to bottom. Postage stamps to the value of 3 pence (6 cents) for every 30 words must be forwarded. The Postmaster-General states that the new scheme, while giving considerable additional facilities to the public to meet those cases of emergency which lead to the present limited demand for a Sunday delivery of letters in London, will add little or nothing to the amount of Sunday attendance by the post-office staff. The telephonists and others who will deal with the messages in London must in any case be on duty, the telephone exchanges being open all Sunday. On the other hand, there will probably be some reduction in the force now employed to deliver telegrams and express messages on Sunday.

ENGELBERG-LUCERNE TRANSMISSION SYSTEM.

A Swiss Hydroelectric Generating Station Operating Under a High Head and Having an Unusual Pole Line.

By FRANCIS M. WELDON.

THERE has been in operation now for some years a very successful transmission system connecting the hydroelectric station at Engelberg and the city of Lucerne, Switzerland. The station equipment is not out of the ordinary, excepting perhaps the switchboard apparatus, which is rather elaborate; but difficulties encountered in running the lines through from the generating station necessitated rather unusual pole-line construction over a section of the route.

The greater part of the energy generated at the Engelberg turbine station is transmitted to the city of Lucerne for the supply of the city and suburbs, and from the station lines also run to a certain number of localities of the Nedwald region. Besides this, electricity is supplied to the electric railway which runs from Stansstad to Engelberg. The enterprise comprises a main turbine plant at Engelberg, a 17-mile line to Lucerne, a substation at Steghof for the latter city, and a number of substations which are placed along the transmission line to supply the different localities of the region.

The Engelberg plant is situated upon the Erlenbach, which affords a net fall of 300 m for the turbines. As the plant is laid out for a flow of 1 cu. m per second and admitting an efficiency of 75 per cent for the latter, about 6000 hp is developed at the wheels. This supply is utilized at present by four principal turbine groups of 2000 hp each, one of which serves as a standby. However, as the stream can be counted upon to furnish a flow of 2.5 cu. m per second during seven months of the year, and other tributary streams can be put in use, in the future the output of the station can be increased so as to obtain from 12,000 hp to 15,000 hp by forming a suitable water-storage basin and by using a steam plant as a standby during periods of low water.

At present the daily variations of flow are provided for by a basin which contains 70,000 cu. m and has 22,000 sq. in surface, with 3.5 m depth. The main flume for the turbines starts from the basin and is 2650 m long and has a section of 4.2 sq. m. The flume is tunneled through its whole course, and it ends at a settling basin which lies on the height above the turbine house. From the basin four penstocks will eventually start, two of which have been installed. Each of these is 620 m long and is anchored to concrete pillars with an expansion joint between each anchoring point. The penstock has a diameter of 1 m, and is made up of sections of steel tube 8 m long.

The turbines of the Engelberg plant are of the Pelton type, having automatic as well as a hand regulation. In the plant are now mounted four wheels of 2000 hp for the alternators, two small turbines of 150 hp for the exciters and a 600-hp wheel, which is used for an alternator supplying the Stansstad-Engelberg railway.

Seeing that the frequency used for the electric railway was 33.5 cycles, the simplest solution for assuring the proper working of the system consisted in separating electrically this system from the rest of the plant. For this reason a separate alternator direct-coupled to a turbine is allotted for this purpose.

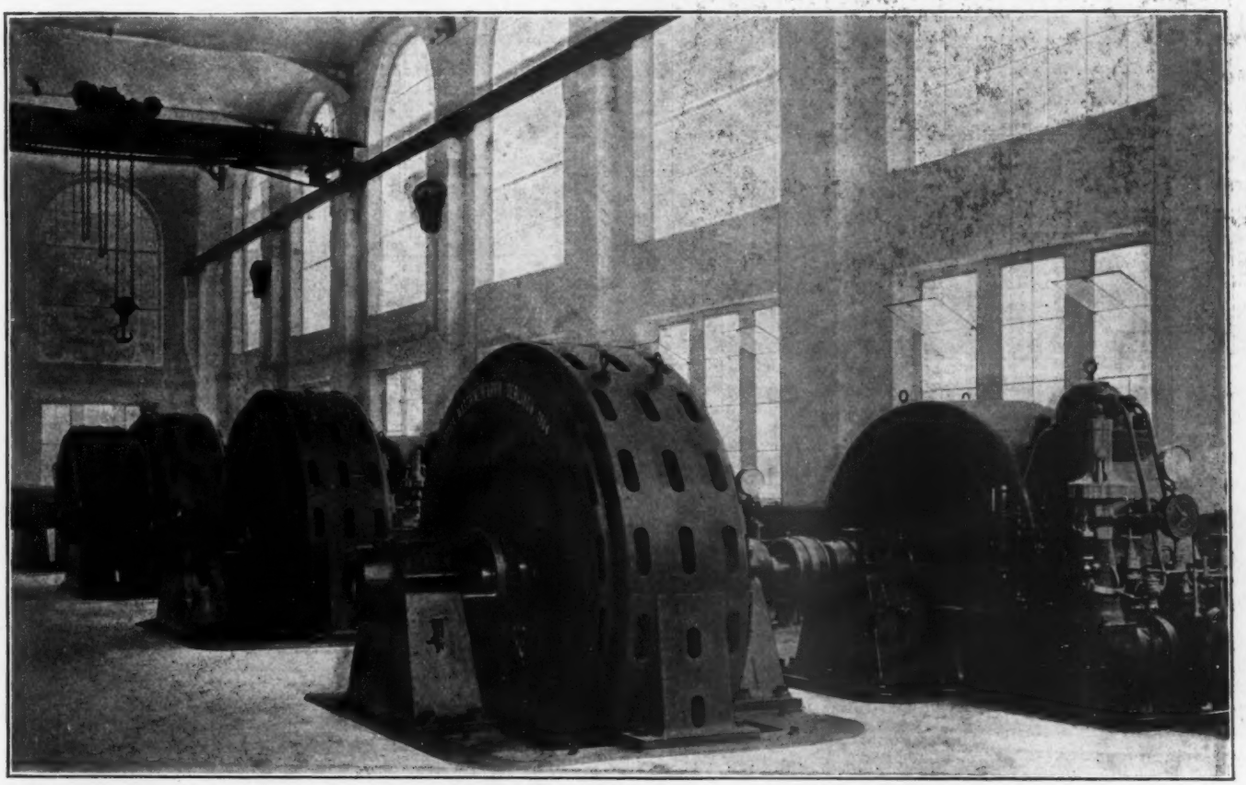


Fig. 1—Interior of the Hydroelectric Station at Obermatt, Switzerland.

Electrical energy is also fed to the network supplied from the electric plant at Kerns in the Obwald region.

The system of lighting mains in the city of Lucerne is installed for single-phase current in order that the lighting should not be influenced by the variations which occur in the motor service. All the other lines are installed on the three-phase system. This arrangement is quite admissible for the lighting distribution in these localities, where the energy taken by the motors is relatively small.

As the tension at the terminals of the alternators is 6000 volts, the construction of these machines offered no difficulty. The electricity delivered to Engelberg is brought by cables connected directly to the 6000-volt busbars. For the motor service which runs to Lucerne the tension is raised from 6000 volts to 27,000 volts in the station at Obermatt. The high-tension pole line ends at the substation at Steghof, where the tension is

lowered from 24,100 volts to 2650 volts. This latter voltage is used as a standard in the city mains of Lucerne. In the substation are placed two motor-generators for the railway lines of Lucerne.

The generating station at Obermatt (Engelberg) is divided into a dynamo-room, switchroom and transformer section. It contains also a special room for a storage battery. The main generator-room is 54 m long and is built to receive six groups of

Fig. 2—Busbar Structure for 6000-volt Circuits in Generating Station.

turbine-alternators rated at 2000 hp each. The original plan allows of enlarging the room so as to contain eight units, while the switchroom was constructed so as to receive apparatus corresponding to this latter number. The alternators are of the three-phase type and are wound to deliver 6000 volts at the terminals, working at a frequency of 50 cycles. They are operated at 300 r.p.m. and are of the revolving field and external ring armature pattern, rigidly coupled direct to the turbines. The outer ring of the machine is in four cast iron pieces and is fixed by two supports to the foundation plate. The laminations of the armature are held between two cast steel end-plates and are dovetailed into the outer iron ring. As to the armature winding, it consists of coils which are lodged in open slots, with 9 slots per pole. The coils are insulated in seamless tubes of micanite, which are held in the slots by fiber strips. They can thus be removed without difficulty for making repairs. In the present case the three phases of the armature are star-connected.

The internal field is formed by a star-shaped cast iron piece which is keyed to the shaft, and on this piece are fixed four cast steel rings, forming the support for the 20 poles of the field. The space which is left between the rings gives a good ventilation for the machine. In the present type of field the pole pieces are laminated and are composed of four sets of plates. The two middle sets lie on a higher level at the periphery than the end sets, and this construction gives a voltage curve which is nearly a sinusoid. On the poles is placed a winding of flat copper strip, and the exciting current is brought by two collector rings in the usual way. The alternator used exclusively to supply single-phase current for the traction line is designed to deliver 600 hp, and it works normally at 800 volts and 32.5 cycles, running at 490 r.p.m. It is excited at 100 volts and is coupled direct to the corresponding turbine by means of an elastic coupling. The armature ring has open slots—six per pole—while the field coils are lathe-wound. A storage battery of 56 cells of large size is mounted in the station. The total capacity of the battery is 1000 amp-hours. It is charged from the exciter circuits.

The switchboard for the alternators, exciters and storage battery is installed on a well-arranged plan. The connections between the machines and the apparatus are made with insulated cables placed in an underground conduit crossing the generator-room. The different devices are mounted in the basement next the dynamo-room, and are lodged in niches or cells. The first cells are used for the traction apparatus and they contain an oil circuit-breaker, a protecting device against high voltages, and the synchronizing apparatus. Following this are four cells for the 2000-hp, 6000-volt machines. Each cell contains an oil circuit-breaker, a transformer for the voltmeter, four transformers (one for the ammeter, one for the wattmeter and two for the circuit-breaker coil and main switch), and a switch for connecting the alternator to the power or the lighting circuit. Since the first installation it was decided to use time relays upon the main switches. In other cells are placed the main switches for the two exciters and of the battery, and also the switches for the battery charge and discharge circuits. The field rheostats of the exciters and also those of the alternators are placed in an intermediate story. A cement floor separates this space from the switchroom above mentioned.

Special attention has been given to the mounting of the busbars. The bars for the 6000-volt circuits are mounted in the middle part of the ground floor, and they are placed around the space so as to form a closed circuit for each bar. On one side are connected the circuits of the alternators, and from the other

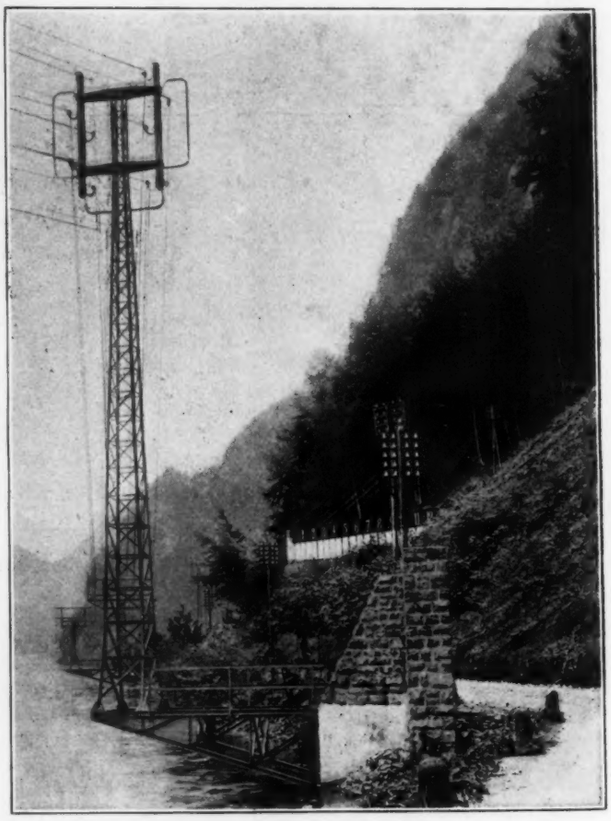


Fig. 3—Transmission Line Along the Base of the Mountain and Overhanging the Lake.

side the leads for the switches of the transformers are run. At another place the cables for the high-tension line running to Engelberg are tapped in. Special cells are used to contain the apparatus and connections for these latter cables where they leave the station, and the cells contain an automatic oil switch, instrument transformers and a protector for over-voltage. Section switches are placed upon the busbars.

For the transformers a separate wing is built against the

main building, and is shut off from the latter by a wall. Single-phase transformers with oil bath and water circulation are used, and each transformer is mounted in an independent compartment of refractory material, which is closed at the front by a rolling metallic shutter. The transformer is mounted upon rails, so that it can be easily handled. A small window allows of inspecting the inside of the cell when the shutter is closed. The pipes for the water circulation are run along one of the side galleries, and any mishap is signaled by an alarm. The station contains at present three transformer units of 700 kw each for the lighting circuit, and for the motor circuit two groups, each composed of three single-phase transformers of 700 kw connected in delta. A similar transformer serves as a standby.

Near Lucerne is located the substation of Steghof, designed to supply the lighting and power circuits of Lucerne and suburbs and also furnishes the energy for the Stansstad-Engelberg railway. The substation is of considerable size, and is divided into three parts: the dynamo-room, switch and apparatus-room for the motor-generators, and a similar room for the transformer apparatus. Owing to the system of cells of cement which are used here, there is no danger of fire, and the apparatus is kept separated. Crossing of conductors is avoided as much as possible, and where this cannot be avoided, all danger is obviated by using partitions between the conductors. On the ground floor are installed the low-tension machines and apparatus, including the motor-generators, busbars, transformers and their low-tension switches. In the second story are placed the high-tension busbars and the corresponding switches of the transformers. The upper floor of the building is used for the switches and protection apparatus for the lines which enter and leave the station.

Fig. 4 shows the two groups of motor-generators for the traction line which have been installed in the station. These groups consist of a 340-kw, three-phase motor wound for 2650 volts coupled to a railway generator. The latter is operated at 575 volts and the speed of the group is 490 r.p.m. A storage battery is connected in parallel with the direct-current circuit. The work of installing the high-tension line from the Engelberg station to the substation was carried out for the city of Lucerne by the contractors and the mounting of the wires was done under the supervision of the city engineers. The Oerlikon firm supplied the transformers and the apparatus of the stations. The line starts from the turbine house and passes along the valley of the Aa River and proceeds toward Stansstad, which is situated on the Four-Cantons Lake. The line then follows the shore of the lake upon the steep slopes of Mount Lopper, transverses Hergiswil and finally reaches Lucerne at the Steghof substation. The total length of the line is 27 km. The original project of an underground line for carrying the whole of the energy needed for Lucerne had to be abandoned, as the contractors would not furnish the necessary guarantees for a tension of 27,000 volts.

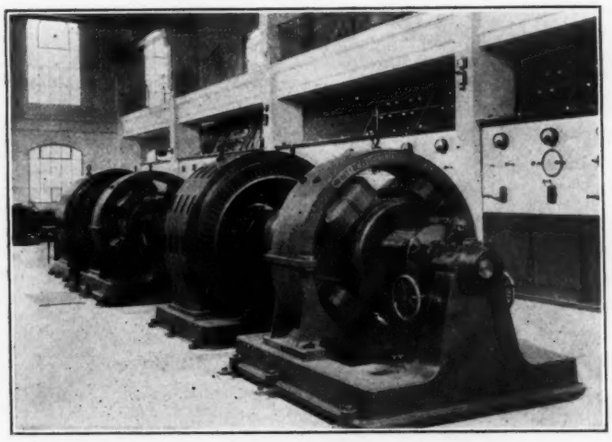


Fig. 4—Motor-generators in Substation at Steghof.

Accordingly it was decided to erect an overhead line, using nine wires of 8 mm diameter, which are mounted on a single series of iron poles. Owing to the arrangement by which the lines can be connected for the power or the lighting circuits and the use of any two of the wires for the lighting lines, each of the wires can be used as a reserve for the others. The distance between the lattice-work poles of the line is generally 60 m, but 120 m distance is used on the slopes of Mount Lopper. As will be observed in the engraving, the poles are provided at the upper part with two cross-arms of channel iron to which are fixed two vertical timbers of treated oak. The brackets of the insulators are screwed to these timbers; the distance between the wires is fixed at 1 m. The poles are grounded, and are interconnected by a ground wire formed of a 5-mm copper wire. At every tenth pole the latter is connected to a ground plate of 1-sq. m surface, which is joined to the pole by a wire. The poles also carry a telephone line which connects the different stations.

Fig. 5—Switchgear for Alternating and Direct-Current Circuits in Substation at Steghof.

The construction of the line between Stans and Hergiswil offered some difficulties of a special character. On one side of the route rise the steep slopes of Mount Lopper and on the other side is the lake, which has a great depth next the shore. On the outer edge of the route is mounted a telegraph and telephone line which could not be displaced. On the other hand, the road is exposed to the fall of rocks, especially during the spring. Under these conditions it was impossible to run the line along the slope of the mountain nor to place the poles on the lake bottom. The poles are mounted upon ironwork brackets which project out for 6 m over the lake and they are fixed to the shore by means of a cement foundation. They are spaced at double the standard distance, giving 120 m, in order to find a suitable lodging place for the foundations. On the other side of the route were built solid walls which protect the poles from falling rock. In this way the engineers succeeded in running the high tension line without disturbing the existing line and also in protecting it against avalanches.

THE ELECTRICAL DISTILLATION OF TURPENTINE.

By O. Higman, Jr.

In view of the apprehension with which the depletion of the world's forests is viewed by many, it is interesting to note that the process described in this article not only makes economic use of what is at present waste matter at many saw mills, but does so without the consumption of fuel in the form of wood or coal, thus in a measure substantiating the argument that as depletion progresses necessity will be mother to inventions that will alleviate the consequences of the present waste.

The process is the invention of Mr. F. T. Snyder, of Chicago, and the plant in which it is applied is situated at Vancouver, B. C., Can. This plant consists of a wharf, transformer-room, retort-room and storage-room, and has a capacity of two cords of wood per day.

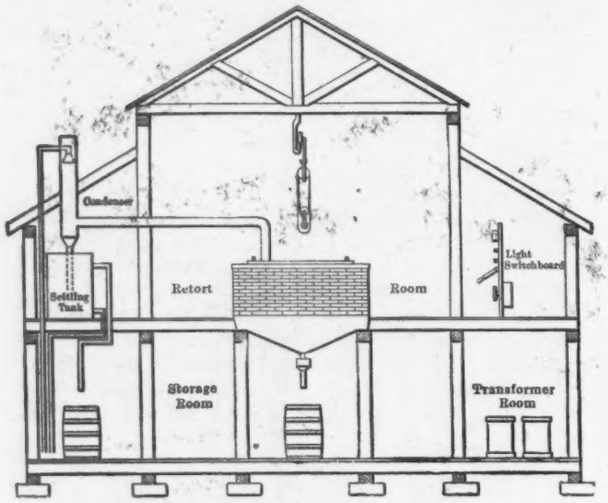


Fig. 1.—Cross-Section of Retort Room.

The transformer-room contains high-tension switches and step-down transformers, reducing the voltage from 2200 to 110, at which pressure current is supplied to the benches. The retort-room, Fig. 1, contains the low-tension switchboard, a bench of four retorts and condensers and settling tanks for the products of distillation. These retorts are arranged as indicated in Fig. 2, heat being supplied by an electric current applied to resistance strips of iron which encompass each retort in the form of a rectangular spiral, adjacent coils being separated by a course of bricks. The storage-room is directly below the retorts, and is so arranged that the resin and pitch drain from the retorts to the barrels in which they are to be shipped.

The wood to be treated is delivered by barge to the company's dock, from which it is charged into box-shaped receptacles, 9 ft. x 4 ft. x 1 ft. 2 in. These are then wheeled into the retort-room and by means of a traveling crane placed in the electrically heated brick setting. The current consumption for each retort ranges from 350 amp to 400 amp.

The bottom of each receptacle is perforated to allow the pitch and resin to drain off, while the top is fitted with a bent flange which engages with a groove filled with pitch on the setting, thus forming an effective seal to prevent the escape of vapors or entrance of air. Each receptacle is equipped with two sets of leads, connecting with direct-reading pyrometers on the switchboard, one of which registers the temperature at the outside, while the other indicates that at the center of the charge, thus enabling the operator to regulate the heat throughout the run.

Vapors pass from the retort to a jet condenser consisting of an upright copper pipe down which a spray of water is directed, condensing the turpentine and tar oil from the other gases which are allowed to escape. This mixture of water and turpentine or tar oil is collected below the condensers in settling tanks from which water and turpentine, or tar oil, as the case may be, is separately drawn off by means of stopcocks arranged at suitable levels. The temperature of the brickwork when a freshly charged receptacle is inserted is about 250 deg. C., and is kept up electrically for about two hours. During this time the temperature at the center of the charge has risen to 45 deg. C., while the temperature at the outside of the charge has risen to 130 deg. C., the temperature at which turpentine commences to vaporize. Current is now shut off, and heat passes from the brickwork to the charge for a further period of two hours, when the temperature at the outside of the receptacles has risen to 150 deg. C. and that at the center to 205 deg. C. At this stage practically all (90 per cent to 95 per cent) of the turpentine has been removed.

During the period of the evaporation of turpentine, the resin in the wood has been melted and drained off through a trap at the bottom of the retort into the barrels in which it is to be shipped. It will be noted that at the end of the turpentine run the temperature at the center of the charge is higher than at the outside, a condition which is due to the liberation of latent heat from the hydrocarbon undergoing decomposition.

At this point the charge we have been considering is removed to an adjacent setting, where the temperature of the charge continues to rise without further application of electricity. The receptacle is now connected to another condenser by means of a separate pipe, in order to extract the tar oil without fouling the turpentine system.

During this part of the run the temperature at the center of the charge rises to 375 deg. C., at which point the tar oil and pitch, or wood tar, are all extracted, and nothing but charcoal remains in the receptacle. The receptacle is now lifted from the bench and placed vertically upon a sand floor, the sand sealing the perforated bottom and protecting the charcoal from combustion.

About three hours is allowed for the charcoal to cool, after which it is packed in sacks ready for shipment. This charcoal, which is of an exceptionally fine grade, is known as "theoretical charcoal" and contains but 0.25 per cent of ash. The entire output is at present used by powder manufacturers, but owing to the fine quality and high compressive strength should readily find other markets. The turpentine is rated as equal to the best Southern spirits of turpentine.

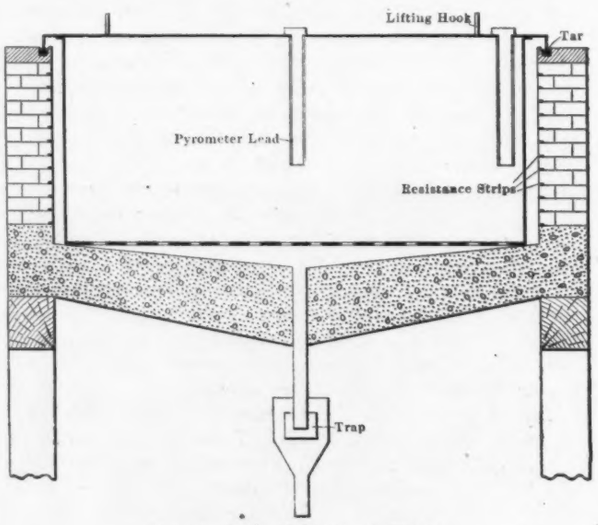


Fig. 2.—Cross-Section of Retort.

The amount and kinds of products derived from any supply of wood depend on the nature of the wood used. The following figures indicate the results being obtained from British Columbia coast fir, while the comparative statements of costs give an idea of the commercial success of the process.

The treatment of 100,265 lb. of wood yielded the following average results per cord:

Turpentine	6	imperial gallons
Tar oil	15	imperial gallons
Resin	23	pounds
Charcoal	1,240	pounds
Pitch	20	pounds

Owing to improvements made in the condenser, the last 40,000 lb. of the foregoing gave:

Turpentine	7.5	gallons per cord
Tar oil	18	gallons per cord
Resin	38	pounds per cord
Charcoal	1,338	pounds per cord
Pitch	20	pounds per cord

The following estimate for cost of production and value of product is claimed to apply to a 40-cord per day plant, about to be erected:*

Wood delivered	$2.75 per cord
Electricity, at $25 per kw-year	1.50 per cord
Labor	1.00 per cord
Packing and other expenses	3.50 per cord
Total cost of production	$8.75 per cord
Turpentine, 6 imperial gallons at 75 cents	$4.50 per cord
Tar oil, 20 imperial gallons, at 60 cents	12.00 per cord
Resin, 60 pounds, at 3 cents	1.80 per cord
Charcoal, 1300 pounds, at $20 per ton	13.00 per cord
Pitch, 20 pounds, at 3½ cents	.65 per cord
Total value of products	$31.95 per cord

*Vancouver prices.

Still further economy could be gained by utilizing the inflammable gases after extracting the ammonia and acetic acid.

The writer is indebted for much of the information in this article to the inventor of the process, Mr. F. T. Snyder, and to the Electric Turpentine Company of Canada, owner of the Canadian patents. Mr. Snyder presented a paper on the subject of the process at the Albany convention of the American Electrochemical Society, April 30, 1908.

ELECTROLYSIS BY EARTH CURRENTS.

Reversal of the Conceptions Usually Held.

By William A. Del Mar.

THERE is something radically wrong with our usual methods of making electrolytic surveys. The surveys are often most elaborate, but it is seldom that the engineer in charge is quite sure that they prove the existence of trouble and he is usually unwilling to spend the tangible assets of his employer to ward off a bugaboo the existence of which he is not quite sure of and which, in any case, carries on its destructive work underground where it cannot be seen. In some cases, to be sure, the engineer installs bonds or insulating joints, according to his individual idiosyncrasies and assumes that this closes the electrolysis incident. In other cases no action is taken, even when indications of electrolysis are quite positive, because of lack of faith in the standard remedies; and it must be admitted that it is questionable whether the ministrations of the electrolysis doctor have ever effected a sure cure.

The entire subject of electrolytic surveys and remedies has been in a chaotic condition since the beginning of electric traction, and would probably have remained so but for the work of two young Englishmen, Messrs. J. G. and M. G. Cunliffe, who, as the result of an electrolytic survey of the city of Manchester, have published as admirable elucidation of the subject.[1]

The present writer was immediately attracted by the ideas of these investigators, and pens this article in the capacity of a missionary of the new electrolytic gospel.

In the past engineers have been confused by the complexity of underground pipe and cable systems, thinking that electrolytic surveys are greatly complicated by the confusion of the labyrinth of underground conductors. This unfortunate conception arose from the assumption that pipes, rails, cable sheaths, etc., constitute a series of conductors enclosed in a more or less insulating medium which is almost, if not entirely, short-circuited by these conductors. The fact is that the earth so far from being a poor conductor is an excellent one, and that it is generally more correct to consider the pipes, etc., as short-circuited by the soil than the reverse. The paths of the earth currents in a typical case are shown in Fig. 1.

The former conception gave rise to the idea that the electrolytic zone is of indefinite area, thereby immensely complicating all problems relating to it. The new conception, backed by ample experimental data, simplifies electrolytic problems by reducing the zone of danger to a definite area, dependent only upon the drop in the disturbing rails. There is also considerable confusion about the deductions which may be drawn from potential readings. This confusion is quite eliminated if the readings are considered in the light of the new conception mentioned above. The ideas thus briefly suggested are presented below in greater detail.

CONDUCTIVITY OF THE EARTH.

The advent of the single-phase railway has resulted in the occurrence of greatly increased potential drops in the return rails with the result that the earth currents often reach a considerable magnitude. While giving rise to no appreciable electrolytic danger, these earth currents have demonstrated, by their magnitude, the importance that should be attached to the earth as part of the return system.[2]

Thus on the Midland Railway[3] it was found that the current did not continue along the rails for any considerable length, but within a few hundred yards of the car sank gradually into the earth to re-enter the ballast at a very short distance from the power station.

H. F. Parshall found that on a line eight miles long the return current was 60 per cent of the total.

Probably the most exact data of this kind are due to Mr. A. W. Copley,[4] who stated that on the New York, New Haven & Hartford Railroad the percentage of current in the earth is 25

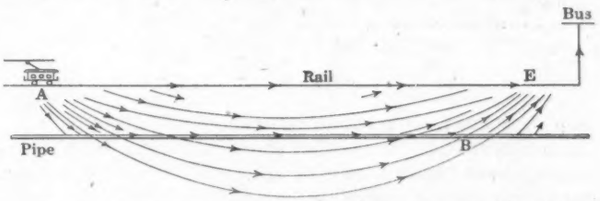


Fig. 1.—Paths of Leakage Currents in Railway Circuits.

per cent on the four-track sections and 60 per cent on the single-track sections.

This condition is not confined to single-phase systems; M. Claude[5] found that in complicated direct-current networks the stray current was from 25 per cent to 30 per cent of the total. This amount is exceeded by at least one trolley line in Greater New York.

Messrs. J. G. and M. G. Cunliffe, describing their experiments at Manchester, went into the subject of earth conductivity with great care and reached the conclusion that for great distances the resistance of the earth is practically zero except near the electrodes, where the path of the current is necessarily restricted in cross-section. These experiments showed that with increasing distance the value of the resistance increases rapidly, soon attaining a maximum, after which it falls less rapidly. This variation is due to the fact that the resistance tends to rise owing to the increasing length of the path and to fall owing to its increasing area as the current streams spread out, the balance point being indicated by the attainment of maximum resistance.

The net result of these observations and experiments is that the conductance of the earth is of such magnitude that it has to be reckoned as an important factor in considering the return paths of railway current.

THE AREA OF THE ELECTRIC ZONE.

It was shown by Messrs. Cunliffe that when a difference of potentials is established between plates of equal area in the

[1] Journal of the Institution of Electrical Engineers, London, September, 1909. No. 197.

[2] In this connection, earth currents due to inductive action are unimportant compared with those due to conductive leakage.

[3] J. Dalziel and J. Sayers, *Trans.* Institution of Civil Engineers, London, 1909.

[4] *Trans.* American Institute of Electrical Engineers, 1908.

[5] *L'Eclairage Electrique*, p. 141. Vol. 24, 1900.

ground, the potential gradient is rather steep near the electrodes owing to the restriction of the current stream to a limited area, and is almost flat in the intermediate space where the area of the earth path is less restricted. Plotting curves of potential drop, these experimenters found that almost the entire drop occurred within a certain radius of the electrodes, this radius being practically independent of the area of the electrodes, obtaining the same result even when track rails were used instead of plates. A little consideration will show that when one is concerned only with leakage from rails to earth, the rail itself is both anode and cathode, and, therefore, both of the steep parts of the potential gradient must occur within a limited radius of the rail. Experiments with earth plates and with rails in actual service showed that with a total potential drop of 7 volts this radius was about 3 ft. In other words, the potential gradient was steep within 3 ft. of the rail and almost flat beyond that radius.

The significance of experiments with 7 volts is obvious from the following regulations of the Board of Trade of England: "Where the return is partly, or entirely, uninsulated a continuous record shall be kept by the company of the difference of potentials during the working of the tramway between the points of the uninsulated return. If at any time such difference of potential between any two points exceeds the limit of 7 volts, the company shall take immediate steps to reduce it below that limit."

Mr. Trotter, electrical engineer of the Board of Trade, has stated that his experience amply confirms the experimental results of Messrs. Cunliffe with respect to the radius of potential disturbance. In America the Government regulations are not only less strict than in England, but lenient as they are they are practically not enforced, with the result that very high differences of potentials in return rails are of very frequent occurrence. The writer found a certain trolley line in an outlying district of New York City to operate with frequent potential peaks of over 25 volts drop in the return rails. In this case the potential disturbance extended to a radius of about 50 ft.

It is important to observe that beyond the radius of potential disturbance, the earth is at practically uniform potential, a fact of fundamental importance in what follows. This condition is obvious from the high conductance of the earth and the absence of disturbing potentials outside of definitely limited zones.

THE UNCERTAIN SIGNIFICANCE OF THE ORDINARY POTENTIAL READINGS.

It has been the usual practice to take potential readings between all available grounded metallic systems and estimate the danger of electrolysis from the magnitude and direction of these readings. Thus, if a difference of potentials of 5 volts were discovered to exist between a water pipe and a track rail, and the water pipe were found to be positive, it would usually be concluded that current was leaving the water pipe to enter the rail and that the water pipe was, therefore, exposed to danger of electrolysis.

This kind of deduction is likely to lead to false conclusions, as is evident from the following considerations: If a pipe is situated outside the electrolytic zone, it is at earth potential at all points. As the earth is at uniform potential ouside of the disturbed zone, the pipe will be at uniform potential throughout. Suppose that the rail is at earth potential at some point (a very probable condition), and that there is a drop of potential in the rail. There must then be a difference of potentials between the pipe and rail at all other points. However, since the pipe is beyond the disturbed zone, a difference of potential between the pipe and rail is no criterion of electrolytic conditions. Similarly, the absence of any difference of potentials does not prove that electrolysis does not exist. Consider a pipe situated within the electrolytic zone or zone of disturbed potential; it is in multiple with the earth and with the rail in the zone and, therefore, carries some of the return current. The earth zone and rail are, therefore, like parallel paths of a Wheatstone bridge, through both of which current may be flowing, but between which there will be differences of potentials at certain points only. The absence of potential-difference between a rail and pipe within the disturbed zone, therefore, merely indicates that the drop of potential in the ground is the same as that in the rail and does not show that there is no current flowing from the pipe to the ground. It merely shows that no current is flowing from the pipe to that part of the rail to which the voltmeter is connected.

It is evident from the above considerations that potential readings are likely to be very misleading unless obtained and interpreted with the greatest care and judgment. There are ways of taking potential readings which give positive and trustworthy results, but the discussion of these is beyond the scope of this article as the methods will vary greatly according to local conditions.

BONDING PIPES TO RAIL OR BUS.

The possibility of the occurrence of a great difference of potentials between pipes and rails, in normal earth, has been pointed out and shown to be no criterion of electrolysis. It is therefore, obviously useless to put in bonds on the evidence afforded by high differences of potentials. Better evidence is afforded by the combination of current and potential readings outlined below.

Let E = total drop of potentials in the rails from their anodic center to the point where it is proposed to bond them to a pipe.

e = difference of potentials between the pipe and the rail at the bonding point.

e_1 = same, after the insertion of a connector which carries I amp. The current in the connector may be determined by inserting a low-resistance ammeter.

Then the earth current i after the insertion of the bond will be

$$i = I \cdot \frac{k}{1-k}$$

where

$$k = \frac{e_1}{e} \cdot \frac{E-e}{E-e_1}$$

The anodic earth current from the pipe without bonding would be:

$$\frac{E-e}{E-e_1}(I+i)$$

For example, suppose the total drop in the rails to be 100 volts and the difference of potentials between the pipe and the rails at the bonding point to be 5 volts before the connector is used and 1 volt after. Suppose the current in the connector is found to be 50 amp.

In this case, $E = 100$; $e = 5$; $e_1 = 1$; $I = 50$.

$$k = \frac{1}{5} \cdot \frac{100-5}{100-1} = 0.19$$

$$i = 50 \cdot \frac{0.19}{1-0.19} = 12 \text{ amp, approximately.}$$

Without bonding the current would be

$$= \frac{100-5}{100-1}(50+12)$$

$$= 59 \text{ amp, approximately.}$$

The effect of the bond in this case is, therefore, to reduce the current from 59 amp to 12 amp, which, although a decided improvement, would not entirely eliminate electrolysis.

By such calculations the effect of a bond may be estimated as far as its effect upon the earth current is concerned. There are, however, other effects to be considered.

It is too frequently assumed that the current enters the pipe at a point distant from the bus and leaves at a point near the bus. This is not the whole truth, for the pipe is at all points shunted by the earth, and current enters or leaves the pipe at all points.

It should always be remembered that the source of disturbing earth potentials is the current from the cars. The pipes in the region under and about the cars are cathodic and, therefore, immune from electrolysis. Cathodic regions, therefore, travel

with the cars. There are regions which are alternately cathodic and anodic, and, finally, near the power station, there is a region permanently anodic. It is in this last region that the connections to the pipes should be applied, if at all. The limits of these three regions should be determined and the most advantageous location for the bond settled with a full knowledge of these limits.

There are, however, several arguments against the use of connections to the pipes and these should be carefully considered before their final adoption. (1) If one piping system is connected to the rails or bus, it is rendered negative to all other underground metallic structures, and, therefore, attracts current from the latter and exposes them to electrolytic danger. An interconnected piping system thus becomes a part of the trolley return circuit, and the owner becomes a party to whatever damage may occur in the others. (2) A considerable current in a gas pipe is a serious fire hazard and in a lead cable sheath is a menace to continuity of service. (3) Electrolysis is promoted at all imperfect joints and connections.

In considering the effects of a connection between pipes and rails it should be remembered that the current flow between the pipe and the rail is not inversely proportional to the resistance of the path between them, as might be deduced from an imperfect application of Ohm's law. It should be remembered that there are other resistances in the circuit and that halving the resistance of one path of the circuit by means of a connector does not halve the current flow in the earth. The exact relation between current and bond resistance is given below, assuming the drop of potentials in the rails to be constant.

Let E = drop of potential in the rails.

R_a = the resistance of the current path from the rail to the pipe in the region where the pipe is cathodic plus the resistance of the pipe itself throughout its cathodic region = resistance of AB of Fig. 2.

R_g = the resistance of the pipe, and of the earth between pipe and rail, in the anodic region = resistance BDE of Fig. 2.

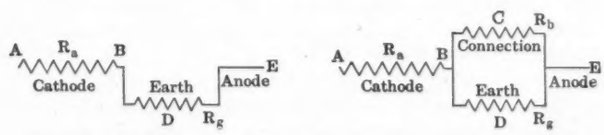
R_b = the resistance of a connector short-circuiting the anodic region and joining the pipe to rail = resistance BCE of Fig. 3.

Then the anodic earth current, in D, is

$$i = \frac{E}{R_g + R_a\,(n+1)}$$

where $n = R_g \div R_b$.

Now this formula is of no practical use as R_g and R_a are usually unknown quantities; it is, however, very convenient for the purpose of discussing in a general way the question of inter-



Figs. 2 and 3—Resistance Equivalents for Circuits in Fig. 1.

connecting pipes and rails. For example, an examination of the formula shows that unless n is quite large the earth current is not greatly reduced by the insertion of a connector.

Thus, let $R_a = 0.002$.

$R_g = 0.001$.

$n = 0.1$ with the connector and $n = 0$ without connector.

$E = 5$.

Then the earth current with the connector is

$$\frac{5}{0.001 + (0.002 \times 1.1)} = 1560,$$

and without connection it is

$$\frac{5}{0.001 + 0.002} = 1660,$$

a difference of only about 6 per cent.

In another case, let

$R_a = 0.002$.

$R_g = 0.001$.

$n = 10$ with connector and $n = 0$ without connector.

$E = 5$.

Then the earth current with connector is

$$\frac{5}{0.001 + (0.002 \times 11)} = 217,$$

and without connector it is 1660, a difference of 87 per cent, but not sufficient to eliminate entirely the anodic current.

It should be observed that a long connector is generally useless because the earth resistance is low over long distances and the bond resistance is correspondingly high, making n quite small.[6]

THE CURE FOR ELECTROLYSIS.

The net result of the new ideas on electrolysis is that corrosion can be completely eliminated in the following ways only: (1) Keeping all cable sheaths, pipes, etc., outside the danger zone, which is generally impracticable, and (2) reducing the area of the danger zone so that it will contain no pipes, cable sheaths, etc. This can be done in one way only, and that is by keeping down the drop in the grounded rails to a very low amount.

Fortunately the drop in the grounded rails may be kept down without using an excessive amount of copper. This may be accomplished by means of insulated negative feeders tapped into the rails at intervals, as is done in the New York subways. The drop in these cables may be of any magnitude without affecting the electrolytic conditions and they may be tapped in at such frequent intervals that the drop in the grounded rails is insignificant. This system is in extensive use in England. Much of the trouble with high-resistance returns is, however, due to improper maintenance of rail bonding. The writer has observed differences of potentials of 42 volts between abutting rails of a 550-volt trolley system in Greater New York.

Another result of the new ideas is that the propriety of connecting pipes and cable sheaths to the rails or bus cannot be determined by potential readings only, but should be the subject of careful investigations.

This article is penned with the idea of introducing the conceptions of the Manchester investigators, but the writer wishes to exonerate the latter from any responsibility for the article, which contains many ideas not advanced by them. In conclusion, it is hoped that this article may stimulate some discussion by our local experts.

FABRE RADIOACTIVITY METER.

Nearly all the ordinary methods of measuring radioactivity are based on determinations by means of accurate electroscopes, of the activity of dried gases derived from a solution, by boiling, and necessitate a well-equipped laboratory. Moreover, the boiling method takes considerable time and does not lend itself well to the study of rapidly decaying radioactivity.

On the other hand, the variable activity of liquids in contact with the open air makes it impossible to make satisfactory measurements of the radioactivity of undried gases which are introduced directly into the ionization chamber.

These difficulties are avoided in the apparatus recently invented by Mr. G. Fabre, and constructed by Messrs. F. Ducretet

[6] The formulas given above are derived by assuming that the circuit shown in Fig. 1 may be represented by those shown in Figs. 2 and 3, before and after the insertion of the connector, respectively. Corresponding points in these diagrams are indicated by the same letters. Both formulas are based upon the assumption that the total drop in the rails, E, is not affected by the insertion of a connector between the pipe and rails.

In the first formula the drop E is equated with the current and resistances in both Fig. 2 and Fig. 3 and the ground resistance in each case is expressed in terms of the current and potential drop. The four equations thus obtained are combined to give the desired result.

The second formula is derived from a consideration of Fig. 3 only, the voltage E being equated with the total current and the combined resistance of the system, and the potential drop across BE with the corresponding currents and resistances. By combining these equations the second formula is obtained.

and E. Roger, of Paris. This instrument measures directly the radioactivity of liquids, and is especially useful for making measurements on water. It is compact in construction and requires no auxiliary apparatus. The novelty of this device lies in the method used for deriving the radioactive gases from the liquids.

The principle of operation is as follows: An aluminum-leaf electroscope *f* (Fig. 2) is hermetically closed and serves as an ionization chamber, and the gases are introduced directly by suction into the tube *T* (Fig. 1), which is exhausted by a vacuum pump. Here they are dried completely by passing over a dense

Fig. 1—Radioactivity Meter.

layer of phosphoric anhydride. The suction is obtained by means of a small hand vacuum pump connected to the tube fitting *Tu* by a rubber pipe. The hollow needle *P* penetrates through the stopper of the vessel and extends into the gaseous vapor over the liquid, thus leading the vapor directly to the tube *T* and the electroscope. Referring to Fig. 1, communication with the liquid to be investigated and the meter is controlled by the cocks *r* and *R* (the latter being a three-way valve).

An additional fitting, which is not represented in the figure, allows the outside air, in the intervals of suction, to be introduced into the body of liquid and pass up through it in bubbles. By alternately boiling in the vacuum and allowing the air to enter, the dissolved gases are withdrawn until the atmospheric

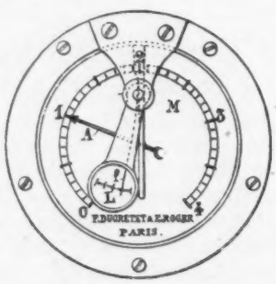


Fig. 2—Radioactivity Meter.

pressure is again established in the ionization chamber, which is indicated by the needle *A* (Fig. 2) of the manometer *M*. The atmosphere of the ionization chamber containing the electroscope then contains, for the larger part, the gases of the liquid under test. As this chamber is hermetically closed and perfectly dry, the radioactivity can be examined without any interruption. By means of an eyeglass *L* the deflection of the leaf *f* of the electroscope may be observed with great accuracy.

With some practice this apparatus enables observations to be commenced 30 seconds after the extraction of the liquid, and curves may be traced during a period of time extending over several days.

PATENTS SHOULD NOT CONFER MONOPOLIES.

By H. Ward Leonard.

DURING the march of civilization the best and most direct paths of progress have been blazed by the inventor. Commercial monopolies, on the other hand, have always been obstacles which have retarded such progress.

A patent is in effect a contract between the Government and the inventor, the intention of which is, that, in return for his making known his invention, the latter shall receive an appropriate return under the protection of the Government.

But why should he receive a monopoly? The monopoly, if effective, tends to create a bar to the very progress which his invention would otherwise cause.

When such a peculiar form of consideration as an "exclusive right" is recited in a contract it is a fair presumption that that consideration is satisfactory to both parties to the contract, and is insisted upon by one of the parties. Which party, then, to the contract which a United States patent represents, is the one that insists that the consideration to be paid to patentees shall be: "Securing for limited time to inventors the exclusive rights to their respective discoveries" (United States Constitution, Article 1, Section 8)?

Certainly it is not the seller of the value represented by the disclosure of the invention, namely, the patentee, who insists that his consideration must be in the form of an exclusive right, and no other form, because inventors were not, originally, and never have been since, consulted as to what would be a satisfactory form of value to be "secured" to them by the Government in return for the value they have created and made available to the nation.

It is evidently the Government, as one of the contracting parties, that insists that the sole value it will "secure" to the inventor is the granting to him for 17 years the exclusive right to his invention.

It will be most unfortunate for the future commercial progress of the United States if the sole return a meritorious inventor can obtain from the Government is the notoriously ineffective patent of to-day.

The best of the inventions which are patented to-day are acquired by the trusts and boards of patent control on terms such as to discourage the inventor from taking out, at his own expense, any other patents. Inventors who combine business ability with inventive capacity confine their efforts to detail inventions, such as they can keep secret and can manufacture with small capital; and those who lack business capacity become embittered failures, and their inventive ability is lost to the nation.

An examination of the existing situation as regards patents leads naturally to the queries:

Why does his Government force an inventor to assume the obnoxious rôle of a monopolist?

Why should not an inventor have the same right as other producers to receive some form of definite tangible return for the acknowledged value the public, as represented by the Government, has received from him?

Why should not the inventors have some voice in the consideration of questions involving the relations between the patentee and the public?

Why should not the public have the right to use, at once, any new and useful result disclosed by a patent, upon the payment of a reasonable royalty to the inventor who has produced the new and useful result?

The writer appreciates his inability to suggest constructive legislation, and realizes that the suggestion of a constitutional amendment is likely to make the reader skip the balance of this article. Nevertheless, it being his conviction, based upon 25 years' experience and observation, that the United States is being hampered in its commercial progress by the granting of exclusive rights to inventors in the form of patents, he makes the following suggestions as to patent reforms, hoping that there may be some germ of value in the suggestions which may be developed by those competent to deal with the subject:

(1) That the words "exclusive rights to" be stricken out of

the article in the United States Constitution relating to patents and that the words *appropriate returns from* be substituted.

(2) That priority of filing an acceptable disclosure of the alleged invention with the Patent Office shall, in the absence of fraud, determine the question of who is entitled to a patent upon the invention, the application to contain a brief general statement of the scope of the alleged invention.

(3) That the Patent Office shall promptly publish, as a provisional patent, the disclosure, together with an appropriate digest indicating the scope of the invention as far as the Patent Office officials can determine by a preliminary search of the art known to them; the applicant to pay a fee to cover the cost of such search and publication.

(4) Upon the expiration of three years from such publication of the provisional patent, the inventor, upon the payment of appropriate fees, shall be entitled to have the Government determine the scope of the invention, if any, disclosed by the provisional patent, and state the invention in suitable claims in a determined patent, and at the same time determine and publish what rate of royalty, as a maximum, a licensee must thereafter pay to the inventor for the manufacture, sale or use of the invention covered by the claims during a period of 14 years. The claims and also the license rates shall be subject to revision by the Patent Office upon proceedings instituted by the inventor or the public, the expense to the Patent Office in such proceedings to be borne by the party initiating the proceedings. There shall be an appeal from any such decision to a United States Court of Patent Appeals.

(5) When such a determined patent has issued and the patentee has sued an alleged infringer, the sole defences which the alleged infringer can raise shall be non-infringement or that payment of royalty has already been made. If the court determines that there is infringement of the claims, and that the royalty has not been paid, an injunction shall issue in favor of the patentee as against the infringer, together with an order for accounting and payment of royalties due the patentee. An injunction so granted shall not be vacated, except by the consent of the patentee, until the royalties due, as determined by the accounting under the order of the court, are paid to the patentee. The party under injunction may appeal from the said decision to the said United States Court of Patent Appeals, whose decision shall be final.

Such a patent system would have the following advantages.

(a) The vast amount of time and money now spent, usually fruitlessly, in trying to determine, prior to the issuance of the patent, how to define the invention and who made it, would be largely avoided, because priority of filing (except where fraud was charged) would settle the question of who was entitled to the patent, and the Patent Office authorities with the published art before them could, after three years' progress in that art, state in a few claims the scope of the invention with a degree of accuracy and fairness sufficient for the purpose.

(b) Interferences, except to determine priority when fraud was charged, would be eliminated. This would eliminate the most unjust, absurd, expensive and useless part of our present patent system and would remove the incentive to fraud, perjury, forgery and conspiracy which are stimulated by the present patent system to a most amazing degree in the case of a really valuable invention.

(c) The average inventor, alone and unaided by capital, would be able to secure a reasonable return for any real value he has produced and delivered to the public through his Government. In the large majority of instances, the applicant would find that the prior art would prevent him from obtaining a patent upon that of which he thought he had been the first inventor, and thus there would be saved a large amount of money and time wasted under the present system in pursuing for years appeals, interferences, etc., upon inventions of doubtful value.

(d) Many meritorious inventions now suppressed by wealthy corporate owners or dominated and thus annihilated by patents owned by such corporations, would be rendered available to advance the progress of the arts and manufactures.

(e) The state of the art would be continually advanced many years as compared with that under the present system, because of the prompt disclosure of the inventions, and the rate of advance in every art would be much more rapid because of such prompt disclosure of the latest developments in that art.

(f) A manufacturer could, with moderate capital, enter any of the most rapidly advancing arts without the enormous and unknown liabilities represented by the patents and future patents of the large corporations in those lines, and escape the terrible waste of time and money represented by modern patent litigation.

(g) The dominating, obstructive and exterminating influence now represented by the boards of patent control or other equivalent contracts in restraint of trade in patents would be removed and free competition, under a reasonable royalty, would be open to the best brains and abilities of the nation.

Every civilized man hates a monopoly. This hatred is an inherited and entirely warranted feeling, based upon the experience and record of past centuries. As a consequence of this universal feeling every patentee in endeavoring to sustain the alleged monopoly which has been granted to him by his Government finds that the infringers have associated with them as hostile witnesses to his interests scores of men whose testimony is supposed to be unbiased, but who, in fact, hope that his alleged monoply will be overthrown. Under a system of Governmental license ratio, the testimony of such witnesses would be very different.

A reasonable patent-license fee, revised and adjusted by competent and unbiased Governmental authority, would probably be just as satisfactory to the public as the freight rates, or rates for gas, or similar rates so generally determined by the Government to-day in transactions between the public and those who control something which the public must employ in order to secure the most desirable result.

Modern civilization requires that the Government should determine the maximum rate of anything of value employed in the service of the public. Is it not clear that the inventor discloses his invention to his Government for the public service? That is the sole purpose of the publication contract which the patent represents.

Now since the patent publication is for the service of the public, why should not a properly constituted public service commission determine the maximum rates that a patentee can charge the public, and regulate such rates just as they determine and regulate the rates applying to other public service matters?

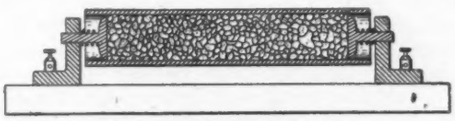
In considering patent reforms it must be borne in mind that the good of the nation is the object of a patent system, and that all other interests must be considered as relatively unimportant.

The patent system best for the nation will be that one which most rapidly and economically discloses the latest inventions; which permits anyone to make use of said inventions on fair terms to the inventor, and which stimulates to the highest degree the inventive talent of the nation.

Our present patent system fails utterly when tested by this standard.

SILICON FOR RESISTOR MATERIAL.

Much interesting information concerning the electrical properties of silicon is given in a patent issued to Prof. Elihu Thomson on Jan. 11. At normal temperature cast silicon has



Thomson Silicon Resistor.

a nearly constant resistance so that upon an increase in temperature up to a red heat the electrical resistance increases only slightly. This variation is very much less than is ordinarily found in the metallic elements; above a red heat the resistance

increases somewhat with temperature, showing a positive temperature-coefficient. This temperature-coefficient is not, however, a constant for all higher degrees of heat and at a temperature approximating that of melting silver the temperature-coefficient reverses in sign so that a further heating causes an actual and rather rapid reduction in the resistance of the unit. This negative temperature-coefficient makes the resistance units herein described suitable for automatic motor-starting rheostats and for other purposes where it is desirable that the resistance should automatically decrease as the impressed voltage or the current increases. The change in temperature-coefficient from a slight positive value to a high negative value thus successively increasing and decreasing the resistance makes the silicon resistance units available for automatic protectors and regulators for a great variety of purposes, such, for instance, as automatic cut-outs for mercury-vapor lamps and other translating devices used in series circuits, or as a means for automatically grounding a circuit to static or other abnormal voltage.

In one of the methods by which the inventor proposes to build a resistor, use is made of uncombined silicon in granular form packed by compression springs in a tube of rough quartz made by melting granulated quartz around a heated carbon tube. Such a resistor is illustrated herewith.

Central Station
Management, Policies and Commercial Methods

PREPAYMENT METERS FOR PUBLIC HALLS.

A central-station manager in Indiana has installed prepayment meters in all the lodge-rooms, dance halls and other semi-public places in his city, which are successively rented by different organizations and bodies of people. This plan of collecting before delivery obviates the former difficulty in placing the responsibility for the payment of bills in these places and has met a rather annoying situation.

CENTRAL-STATION ADVERTISING COPY.

The Westinghouse Company has issued for gratuitous distribution to central stations a book of advertising copy for setting forth the advantages of electric power. Twelve specimens of advertisements are contained, each accompanied by an effective cut to catch the eye of the reader, of which a duplicate is furnished free to a central station upon application. The text of the advertisements is concise and directly to the point, and the type display is skillfully designed. For the guidance of the printer, the style and font of type are indicated for each piece of copy.

ELECTRIC VEHICLE COMPARATIVE COST DATA.

We are indebted to the General Vehicle Company for the following data relating to electric vehicles. As will be seen, the table gives the estimated annual kw-hours of average demand of given electric vehicles as compared with the number of arc lamps, incandescent lamps or flatirons of equivalent kw-hours demand:

Type of vehicle.	Estimated kw-hours, average annual demand.	Number of 550-watt arc lamps, four hours daily, 300 days.	Number of 50-watt lamps, one hour daily, 300 days.	Number of flatirons, three hours per week.
5-ton truck.....	11,280	17	752	144
3½-ton truck.....	9,360	14	624	120
2-ton truck.....	7,440	11	496	95
2,000-lb. wagon.....	5,520	9	368	70
1,000-lb. wagon.....	4,520	7	304	58
Domestic vehicles....	2,400	4	160	30

HEAT UNITS PER KW-HOUR IN A MEDIUM SIZE PLANT.

A central station in the middle west using a very cheap grade of slack coal and having compound condensing engines in sizes ranging from 1000 kw to 300 kw has an average coal consumption of about 6 lb. per kw-hour. The coal used only has about 8000 lb.-Fahrenheit heat units per pound, so that the heat units per kw-hour average about 48,000. Inasmuch as some of the very largest and most efficient plants in the country require 38,000 heat units per kw-hour, this record is very good. It has been attained by careful attention to all the details of station operation and by keeping the engines in operation proportioned to the load to be carried, so that the engines are well loaded at all times.

COMPLICATED CONSUMERS' BILLS.

Considerable difference of opinion exists among central-station men as to the amount of information which should be conveyed on the consumer's regular monthly bill. Some bills go into great detail, giving the meter readings this month and last month, and, in fact, show the whole process of figuring by which the amount due from the consumer is arrived at. On the other hand, some companies go to the other extreme of giving only the dollars and cents due at the end of the month. In this, as in most other things, there is usually to be found a happy medium.

In small towns it is a question whether one consumer in a hundred pays any attention to the figures on consumption in kw-hours given on his bill. All the average consumer cares about is the total amount of the bill. If he objects to this amount and makes a complaint, it is a simple matter to go through the records with him completely at the office. It is, therefore, held by some to be unnecessary to go to the labor each month of making out all the figures of the transaction on each consumer's bill, being, in fact, a waste of labor; that the meter records must all be on file at the office, and it hardly seems necessary to copy them on the consumer's bill each month, when so few ever look at them.

WIRING OF SMALL HOUSES AND MEETING COMPETITION.

Several articles have appeared in these columns lately regarding the wiring of small houses at low cost and the meeting of competition of gas and kerosene. In this connection the policy of a small company operating in a town of about 4000 inhabitants where there is natural gas competition may be of interest.

The majority of houses to be wired are single-story frame buildings, which can be wired ready for lamps at a low expense per outlet. In many cases the cost is less than $1.50 per outlet.

The company makes it a special point to sell tungsten lamps for all outlets where there is much use and where the consumer is likely to want considerable light. In fact, the company discourages the use of common carbon-filament lamps as much as possible. This it does in self-defense, as the general use of common carbon-filament lamps would create among consumers an idea that electric light was too expensive as compared to 30-cent natural gas, and the results in illlumination would also be poor as compared to that of gas mantels when they are new. In the ordinary small living room, dining room or kitchen the only lamp necessary is one tungsten at the ceiling, either controlled by a wall switch or by a pull chain socket.

A 60 or a 40-watt tungsten lamp so installed, with proper reflector, will give excellent results at low cost, and does away with the necessity for an expensive chandelier. Thus not only

is the cost of wiring and fixtures kept low, within the reach of the customer's purse, but good illuminating results are secured. This company believes that it is much better to persuade the consumer to put his money into tungsten lamps than into fixtures, which are not usually suited to the use of tungsten lamps. If the small consumer desires fixtures he is given those of the ceiling type or of the single pendant type, which extends only a few inches from the ceiling.

RENTING OF SMALL MOTORS.

It has been found by central-station companies desirous of rapidly building up a motor load in a town where there has been little electric power service, that one of the quickest ways to get electric power introduced is to put out motors on trial. If good judgment is used in the installation of these motors by the central-station companies, they will nearly always remain in service, and the consumer will accept and pay for them.

Another plan which has its strong point is that of renting small motors to consumers for a short time, or, in fact, for any length of time the consumer is willing to use and pay for them. The rate of rental should be high enough so that there is considerable inducement for the consumer to purchase his own motor. In the meantime, the consumer is not in any way tied up against his will to the use of the motor. If the motor is rented instead of being placed on free trial, there is considerable inducement for the consumer to end the rental proposition and begin the purchase of the motor.

Along with the motor-rental plan it is good to have a plan of installing motors to be paid for by installment. This spreads the first cost of the motor out over a long enough period so that the consumer will frequently put in a motor where he otherwise would not.

DIPLOMACY AND DETECTIVE WORK IN SETTLING COMPLAINTS.

Mr. C. N. Stannard, secretary Denver Gas & Electric Light Company, tells of a clever bit of diplomacy and detective work in settling the complaint of a certain consumer of that company regarding a bill for electricity incurred while the consumer was out of town and his house closed. This consumer had been away in the mountains for some time, and was astounded to receive from the company a good-sized bill for electric light consumed while his house had been shut up. The consumer received this bill by mail before he had returned to the city, and immediately wrote the company a letter, explaining that he had not been in the house for a month; that at last he had "caught a robber corporation red-handed," etc., etc., along the lines with which every complaint clerk of a gas or electric company is familiar.

The company's representative who was assigned to the work of locating the trouble, after a little investigation wrote to the consumer requesting that he call at the company's office before going to his home when he returned to the city, as perhaps the company might be able to explain to him the reason for his large bill. This letter evidently aroused the consumer's curiosity to the point that he did actually call at the office before going to his house when he arrived in the city. A representative of the company went with this gentleman to his home. It may be said here that one of the complaints which the consumer had was not only of the high bill rendered, but of the fact that any bill had been rendered at all, for his house had been locked up, and he said it was impossible for a representative of the company to obtain access to read the meter. Before this consumer and the representative accompanying him arrived at the house, the representative called his attention to the fact that his electric light meter was near a back porch window and could easily be read from the back porch. It was not, therefore, necessary for the meter reader to enter the house to read the meter. This the consumer was forced to admit, and to withdraw his unjust charge that the company made its charges without any reading of the meter. Upon arriving at the house the company's representative requested the consumer to accompany him on a tour of the house to see the condition of each lamp and socket, no lamp or socket to be touched in the meantime. Of course, it was suspected that the consumer had gone away leaving some lamp burning. No lamp was found burning, but one socket was found with the key turned in a position to turn the lamp on. The lamp, however, was burned out. Of course, the consumer did not readily understand how the existence of a burned-out lamp on a socket with a key turned on had a bearing on his bill until the company's representative got a good lamp from another socket and put it into the socket where the burned-out lamp had been. This demonstrated forcibly to the consumer that the lamp which caused the high bill had probably burned until it had burned out, and the consumer was satisfied that the bill was just. In fact, he practically admitted that he had gone and left this particular lamp burning. This is an excellent example of how care and diplomacy following up some complaints of this kind may straighten out some complaints which on their surface look very badly for the company, as in this case. The moral of this tale is simply to give each complaint careful attention and plenty of tact and diplomacy.

CENTRAL STATION SUPPLY VS. ISOLATED GAS-ENGINE SERVICE.

In the competition of gas and electric companies for motor-service business in urban centers much is usually made of the argument that economy of production justifies an independent installation. The gas man approaches the merchant who has use for electric lighting and motor service, and offers him a rate of from 50 cents to 75 cents per 1000 cu. ft. on gas used only for engine work. Noteworthy savings in the yearly bills are promised. About this time the electrical solicitor becomes acquainted with the situation, and finds that some keen calculating must be done in order to save the day. He needs specific figures showing that in many cases the margin between the cost of central station service and the total yearly expense of operating and maintaining a gas plant is so small as to be negligible. The more data he can summon at such a time along this line, the better will be his chance of retaining his customer or of securing a new patron in case the consumer has never received central-station service.

A recent investigation of an isolated plant gas-engine situation by Mr. F. W. Dean, of Boston, illustrates how close may be the annual costs of an independent plant and central station service when all the important items in the case are considered. From the central station point of view the attractiveness of the investigation arose from its independence; the engineer retained by the mercantile house had no interest other than the securing of electricity for motors and lamps at the lowest annual net cost, and was inclined neither toward the electric light company of the city in question nor toward the establishment of a separate plant by the house. The establishment was a large dry goods store located in a downtown section of the city. Its service required the use of about 300 16-cp lamps, 88 100-watt tungstens, 63 40-watt tungstens, two 5.5-amp arc lamps, and two electric elevators aggregating 33 hp. The total annual energy consumption is about 110,000 kw-hours, costing at the prevailing central station rate of 4.7 cents, $5,232.

It was determined that the installation of a gas engine plant to handle this business, with city gas used for fuel in the engine cylinders, would cost $12,270, the plant including three 25-kw engine-generator units erected in place with the necessary piping, switchboard, balancer set, wiring and conduit work. That is, the installation cost per kilowatt of plant rating would be $163. The fixed charges were figured at 13 per cent on the first cost, and were composed of: interest, 5 per cent; depreciation, 5 per cent; repairs, 2 per cent; insurance and taxes, 1 per cent. These assumptions brought the annual fixed cost to $1,595. Operating expenses came to $2,965, the latter being

made up of gas consumption for 110,000 kw-hours, 3,410,000 cu. ft. at $2,225; attendance, $540 (this in excess of present requirements in an established boiler room); oil, waste and supplies, $200. On the basis of these figures there would be an annual saving of $672 by the use of gas engines, the estimated cost of production in the isolated plant being 4.15 cents per kw-hour. Mr. Dean's investigation concluded with the statement that it would hardly pay to install gas engines unless the house should sell energy to nearby tenants.

It is interesting to note in addition to Mr. Dean's study of this situation, the general bearing of service reliability on the gas-engine question in connection with isolated plants. Where such a close margin exists between competitive sources of energy, there is little doubt that the service of a well-established central station is worth the difference. Gas engines in isolated plants are frequently neglected; their economy is not seldom overrated by interested parties, and they also take up space which is extremely valuable in some locations. The central station has more to fear from steam competition than from the rivalry of illuminating gas in the field of small motor service.

CONSUMERS' ACCOUNTS AND BILLING METHODS.

A description in detail of the various methods in use for keeping meter records, for consumers' accounts and for billing with accompanying forms would extend through several volumes. The scope of the present article is therefore limited to outlines of a few of the methods in use among some of the principal central stations of the country.

LEDGERS.

The common commercial form of ledger, with the left-hand side of the page for debits and the right-hand side of the page for credits, was probably the first employed, and is still used by many very small companies. One might go much further and fare worse, for when one views some of the complicated productions in loose-leaf ledgers used by some of the larger companies he is tempted to exclaim, "Back to the simple life!" However, the common, old-fashioned commercial ledger is somewhat too simple to facilitate the work of an up-to-date central-station bookkeeper.

Leaving aside the standard commercial form of ledger employed in all kinds of business, there are two kinds of ledgers which are most extensively used among electric lighting companies. One of these is a very large and imposing volume (too large to go in the size of safe likely to be owned by a small company) which has a line for each consumer, ruled horizontally, and a set of vertical rulings to cover each month of the year. The vertical column for each month includes the regular charges, rebates and discounts, amount credited or paid and the balance left at the end of the month. The footings of the column given to regular charges and balance unpaid last month should balance with the footings of the columns entitled discounts, amount credited and balance due at end of month. Each page can be footed up and the balance obtained at the bottom of the page, which will reveal whether any errors have been made in footings or in entries. The consumer's name usually appears at the left-hand end of each horizontal line. The page is usually of sufficient size (that is, it has enough vertical monthly rulings) to last a year or six months. This form of ledger is the favorite among many companies largely on account of the facility with which footings and balances can be made and errors discovered. The chief objection to it is the size and the fact that it is so inflexible as regards the addition of new consumers. When a new year is started some companies allow several vacant lines between consumers upon which new consumers can be added. However, no one knows just where these new consumers will come in. Other companies fill the ledger page solid full and put all additions after the first of the year in another part of the ledger. Sometimes consumers are kept alphabetically, and at other times they are kept according to the meter routes. Of this more will be said later.

The fact that new consumers are constantly being added by most central station companies has made loose-leaf and card-index consumers' ledgers popular. On the loose-leaf system one consumer is assigned to each page, and the same is true of the card-index ledger. New accounts are more easily placed in the card-index ledger, but it has the objection, which is likely to be serious in a large office, that employees in the accounting department will remove a consumer's card for purposes of reference and it may become lost. Where a loose-leaf ledger is used it is possible, on account of the abundance of room on a ledger sheet, to enter a large amount of information regarding each consumer's installation, in addition to the simple debit and credit entries.

Many companies have very elaborate ledger forms, on which a complete record of the connected load of the consumer is kept. Many companies have also such a variety of rates that a number of spaces have to be provided for charges, under the various rate systems in vogue. If a company has other services than electric, such as gas, steam heating, etc., the charges on these other services and the particulars regarding the consumer's installation may also be entered on the same ledger leaf.

Some companies do not attempt to keep much of a record of the consumer's installation on the ledger, but rather prefer to keep it in an independent card-index ledger or record. Nevertheless, the consumer's installation record may be a great convenience on the ledger leaf, though it must be remembered that the ledger is essentially a record of money due and money paid.

ORDER OF CONSUMERS' ACCOUNTS.

There are three principal ways of keeping consumers' accounts in order. First, they may be kept alphabetically; second, each consumer may be given a number and the accounts may be kept in the order of their consecutive numbers; and, third, the account may be kept in the order of the meter route.

The advantage of the alphabetical arrangement is that a consumer's account can most readily be found when a credit is to be made. In small companies the alphabetical arrangement is frequently the most desirable. If consumers are given a serial number, a separate consumers' index to numbers is necessary. One advantage of this serial-number plan is, that, whether the ledger be of the loose-leaf type or of the older types, the actual order of the consumer's ledger accounts themselves makes no difference in cases where the accounts are not arranged by meter routes. Consumers are simply added to the ledger in the order of their serial numbers. The bills always bear the consumer's ledger number, as do also the stubs on the consumer's bill, so that a minimum amount of time is consumed in finding the ledger account to credit money paid in.

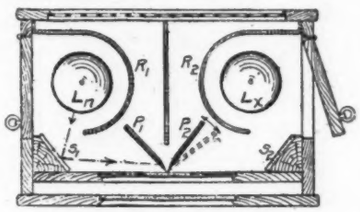
The plan of keeping consumers' ledger accounts in the same order as meter routes has many advantages. The ledgers are posted directly from the meter reader's book, and if the order in the meter reader's book is the same as in the consumer's ledger the work is much facilitated. The proper working of this scheme requires a loose-leaf ledger, although some companies which do not have loose-leaf ledgers are employing the routing plan quite successfully. In such cases the consumer's account is placed in the meter reader's route order at the beginning of each year. New consumers are added in another place in the ledger. If the consumer's ledger accounts are kept in the order of the meter reader's book, it is a necessity in a large company to have each consumer's account identified by a number by which it can be found. The consumers' accounts are then kept in the order of their numbers. To work this system well it is necessary to use a decimal system for intermediate numbers between existing numbers of all consumers. Some accountants use the letters A, B, C, etc., to designate the numbers of consumers coming between old consumers, but this practice will sooner or later lead to confusion and interfere with the smooth working of the plan. The decimal system, however, offers plenty of opportunity for expansion without undue complication. When the number system is started it is easy to leave 100 or 1000 blank numbers between

each of the present consumers. When new consumers come in on the route between two existing consumers, they are given numbers intermediate between the old numbers. For example, if one old consumer is number 2100 and the next consumer 2200, a new consumer coming in between the two on the route would be given the number 2150. If another consumer comes in between 2150 and 2200, he would be given the number 2175. After a number of years if the company grows so that there is no longer room between old numbers to add the new consumers which are coming, as, for example, if a consumer should come in between 2199 and 2200, the new consumer in this case would be given the number 2199.5. A consumer coming in between 2199.5 and 2200 would be given the number 2199.75. With a loose-leaf ledger or card-index ledger, using such system of numbering, consumers' accounts can always be kept exactly in the same order as the meter reader's book. At the same time each consumer's account can easily be found at any moment by reference to the index, which gives the consumer's account number opposite his name, the names being alphabetically arranged in the index.

Wiring and Illumination

PORTABLE PHOTOMETER.

A compactly constructed photometer, which is adapted to use in the field, has recently been put on the European market. A sketch of the device is shown herewith. R_1 and R_2 represent two semi-cylindrical chambers, one containing the standard lamp, L_n, and the other the lamp, L_x, the candle-power of which is to be measured. The light from the lamps is reflected by the mirrors, S_1 *and* S_2, upon the transparent surfaces, P_1 and P_2. P_1, which is illuminated by the standard lamp, is fixed, but P_2 is movable about one edge as an axis. Between the



Section of Portable Photometer.

surfaces P_1 and P_2 is placed a ground glass inserted in the side of the case. A transparent circle in the center of this glass is illuminated by the lamps, one-half by each. Measurements are made by revolving the surface P_2 until both halves of the circle are equally lighted, then the candle-power of the lamp L_x may be read on a scale over which plays a pointer connected rigidly to the surface plate P_2.

GROUNDING OF FIXTURES AND FITTINGS.

By Charles M. Browning.

At intervals during the past 15 years the question of grounding all electric fixtures and of making no attempt to insulate one side of all interior lighting circuits comes up for discussion at meetings of inspectors, underwriter's committee and others interested in electrical wiring rules. The general proposition is that, inasmuch as all interior circuits should now be grounded as a safety precaution, it is unnecessary to attempt to maintain the insulation of the grounded side of the circuit at fixtures. There are many strong arguments in favor of an abandonment of any attempt to insulate the wire and fittings on the grounded side of a circuit. At the present time we go to considerable expense and trouble to keep both sides of each circuit completely insulated. If some of this money were expended on additional insulation of the non-grounded side of each circuit, it would obviously be more effective in maintaining high insulation. At the present time it is the rule to ground all conduit systems, but when we get to the chandelier an insulating joint is put in and the shell of the chandelier and all socket shells are kept insulated from ground. This is evidently an illogical proceeding, when we are attempting by grounding one side of all interior circuits, to limit the possible potential of such circuits to a value as near ground potential as possible. If the fixture shell and tubing were grounded instead of insulated we would have a continuous metallic grounded sheath over all live conductors. At the present time it is possible to have the shell of a socket or fixture at 110 volts above ground potential in the ordinary interior lighting circuit, even where one side or the neutral is grounded.

If such a practice were adopted it would be necessary to abolish all fuses on the grounded side of each circuit and to connect this conductor solidly back to the service entrance. It is not likely that such a change will be made in the immediate future, but, on the other hand, it is quite possible that in the course of a few years wiring construction of this kind will be permitted and later will be common in good practice.

USE AND ABUSE OF LAMP CORD.

By James P. King.

In discussions and papers at meetings of electrical inspectors much has been said about the dangers of lamp cord. Some have even gone so far as to recommend that its use be abolished or prohibited altogether. While such extreme suggestions may be taken as coming from those who do not take a broad-minded view of the matter, and are not likely to be adopted by any responsible committee having such matters in charge, nevertheless they call attention to the necessity of putting more safeguards around the use of lamp cord.

One of the greatest possible dangers in connection with lamp cord is the fact that it can be installed by everybody, and, as a matter of fact, is so installed. It is run around promiscuously, placed under ordinary bell wire staples, among inflammable material and treated generally as an entirely safe proposition which never can cause fire no matter how abused. As underwriters' records will show, a considerable number of fires can be traced to the abuse of lamp cords. Nevertheless, with all its defects, lamp cord is one of the conveniences of electric service, and its prohibition would take away some of these important conveniences. When used purely as a drop cord without being placed where it can be abused, it is as safe as any other feature of electrical construction. Most of the trouble comes when the attempt is made by amateurs to make ordinary lamp cord serve as portable cord where it is subject to all sorts of abrasion.

One feasible suggestion has been made to the effect that all approved cord be made up to the standard now existing for portable cord. This would increase the cost of drop cord, but manufacturers would soon cease to make what is now known as drop cord; consequently, users could not buy drop cord and use it as portable cord. Fortunately, in lighting installations there is not so much use for portable or drop cord as formerly. In other words, we are coming to provide sufficient light for general illumination all over a factory or office and doing away with many of the individual drop lamps which were formerly necessary.

ILLUMINATION OF INDUSTRIAL PLANTS.

At a joint meeting of the American Institute of Electrical Engineers and American Society of Mechanical Engineers at Boston on Feb. 16 a paper entitled "Illumination in Industrial Plants" was presented by Mr. G. H. Stickney. The author confined himself to a discussion of the illumination of factories by electric lamps.

Experience with day and night shifts seems to show that the production of a manufacturing plant is largely dependent upon the quality of the illumination. Not only must there be sufficient light, but it must be so applied as to be of maximum use with minimum discomfort to the workmen.

There are two common methods of factory illumination: general and local. General illumination is best adapted to spaces where the work to be done is scattered and the location of the workmen and machines is not fixed. In cases of this kind it is more economical and gives better results than a local system. In large spaces with workmen and machines concentrated in groups with large, unused spaces in between the local system may give better results than general illumination. Portable lamps should not be given to workmen unless absolutely necessary, as they will waste a great deal of time experimenting with them, and may injure their eyes by the improper placing of the lamps. Where such lamps must be used from time to time it is suggested that they be kept in the toolroom and loaned out precisely as is done with tools.

When changing an existing system over to general illumination, the workman often makes trouble. This may be due to the fact that the improper location of a portable lamp has caused glare and strained his eyes so that he requires more than normal illumination to see well, or it may be that he resents the taking away of the portable lamp.

The designer of an illumination system must take into account the requirements of the building, the dimensions, the location of windows, obstructions, such as belts, shafting, etc., all having an important bearing on the choice of illuminants and their location. Not only must the illuminating engineer study the building, but he must familiarize himself with the processes of manufacture carried on in the building so as to know just what kind of lighting is required by each step. Oftentimes certain steps in the process require special illumination. For instance, it may be that deep recesses in the work must be lighted, or that very fine details requiring higher illumination than that generally supplied are to be dealt with at some particular stage of the process.

In machine shops, general illumination can ordinarily be used to good advantage, although some special operations require local lighting. Ordinary machine-shop work requires about 3 ft-candles, though for rough work 1 ft-candle is often satisfactory, while for fine work six or more foot-candles may be required. In drafting-rooms at least 6 ft-candles should be provided on the drawing board. The selection between general and local illumination depends upon arrangement of the room and other conditions.

The choice of the illuminant depends upon the color requirements, the height and area of the space, the cost of electric energy, the tendency to mechanical vibration, etc. Carbon-filament lamps are used with extension cords and where energy is cheap; where it is impossible to shield the lamp from vibration it may be more economical than metallic-filament lamps.

Tantalum lamps are suited to use on direct-current circuits where vibration causes short life to tungstens. The tungsten lamp is by far the most efficient of the incandescent class, and while the maintenance seems high in some cases, it is being rapidly reduced with the progress of development. Where lamps are protected from excessive vibration or shock, the tungsten is giving an exceedingly long burning life. In choosing between tungsten and tantalum, the cost of energy and the size of unit desired are usually determining factors. Tungsten lamps are used singly or in groups with metal diffusers or prism-glass reflectors. Where there is considerable building vibration they are provided with spring suspensions. In equipping and arranging lamps thought should be given to determining where the light is wanted and what degree of diffusion is required. Where there are dark ceilings, all upward light is wasted, as far as lighting the process is concerned.

Enclosed-carbon arcs, both direct current and alternating current, are used to a large extent in industrial lighting. They are efficient as large units and have a very low maintenance cost. For the higher grades of lighting they are often equipped with diffusers to soften the light and direct it downward at desirable angles.

The intensified enclosed-arc lamp is now available for direct-current multiple circuits. It is more efficient than the enclosed-arc lamp.

The flaming-arc lamp, using the so-called "yellow carbons," is now being used to a considerable extent for the lighting of foundries, machine shops, etc., where the rooms are high, and where is is desirable to hang lamps above the crane.

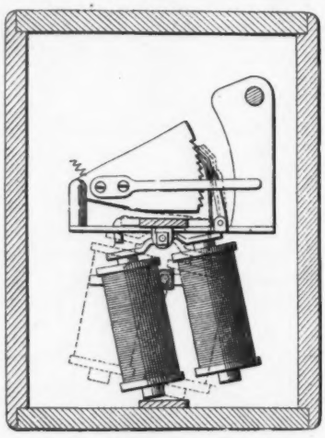
The characteristic distribution of this lamp as now built is particularly adapted to high buildings since the maximum light is thrown directly downward. The light is very powerful, and suited for lighting large areas when hung high. When placed too low the light would be glaring and inefficiently distributed.

The remarkable developments of the last few years, and the remoteness of ideal efficiency, give promise of further development and improvement in illuminants. The importance of these developments in cheapening and at the same time improving the artificial illumination of industrial processes behooves the manufacturer to keep abreast of the times. It should be borne in mind that the first cost of almost every type of lamp is insignificant when compared to the cost of a year's operation.

NEW TELEPHONE PATENTS.

PARTY-LINE SELECTOR.

In the accompanying diagram is shown the selector switch of a party-line system of the step-by-step type. This is a very simple mechanism patented by Mr. C. E. Nicholas. As the magnet swings to the position shown under the combined effect of the permanent magnet and a properly-poled current, it drives the sector through the actuating pawl. The retaining pawl holds



Nicholas Party Line Selector.

the sector during the return movement of the coils. A reversed impulse throws the coils to the dotted position, thereby throwing the actuating pawl away from the sector, due to the angle, and tripping the retaining pawl through the release lever.

BOX FOR TELEPHONE SET.

A special form of box for a telephone set has been patented by Mr. W. M. Bruce, Jr., of Springfield, Ohio. A shallow box forms the foundation. This is to be secured to the wall. Its cover is hinged to it. Upon the cover is mounted a second box with a cover. The cover of the lower box has a fastening reached from the inside of the upper box. The lower box carries the condenser and induction coil, while the other carries gongs, ringer, etc.

TELEPHONE APPLIANCE.

There have been invented several different devices for securing to a receiver of a telephone which through auxiliary sound passages and ear pieces conduct a portion of the sound to the second ear of the user. Most of these devices are attached to the hand receiver by inserting an annulus between the regular ear-piece and the receiver body. The present appliance differs from these. It consists of two ear-pieces with interconnecting sound passages, which clamp over the two ears of the user. One of these has a receptacle upon its back face which receives the ordinary ear-piece of the telephone—that is to say, the hand telephone is held against the ear-cap in the same way as ordinarily against the ear. The inventor is Mr. A. Rector, who has assigned the patent to the Rector Help-a-phone Company.

REPEATER.

The telephone-microphone repeater principle was discovered in the very early days of the telephone, and yet, even though the commercial value of a successful apparatus of this type was recognized with the corresponding incentive to inventors, this type has only been reduced to commercial service within the last year or two. The difficulties of commercial application are many, but one of importance lies in the necessary transformations of energy. Thus, the arriving electrical waves are converted in the receiver part to mechanical motion. This is transmitted to the electrodes of the transmitter part, and, becoming effective as a change of resistance, generates in a secondary circuit a reinforced electrical wave.

When the minute allowable time variation is considered, it seems remarkable that such a cumbersome transformation can be accomplished at all within the allowable limits. Inventors have, therefore, been striving for means to reduce and simplify the operations of the transformation, and it is with this in view that Mr. P. A. Campbell, of Bloomfield, N. J., has produced his condenser repeater, recently patented. To understand its operation, the properties of a condenser must be considered. It must be understood that the potential to which a given condenser is raised by a charge varies inversely with its capacity; further, that the capacity is reduced as the distance of the plates is increased. Now, with the condenser repeater, the condenser is charged by the incoming current with its plates close together, and it is discharged at higher potential into the transmitting circuit with its plates far apart. Of course, there must be a charge and discharge for practically each instantaneous value of the telephone wave—that is, the successive discharges to the transmitting circuit must appear continuous to the ear. The mechanism for accomplishing the result consists of a hollow cylinder whose inner wall is a series of small condenser plates arranged side by side, with their flat sides toward and their length parallel to the axis of the cylinder. There rolls upon this surface a metal drum covered with a thin layer of mica. This drum serves as a second plate for all the small condensers whose first plates lie in the cylinder wall. When the drum is in contact with any plate the rudimentary condenser thus formed is at maximum capacity, and as the drum rolls forward and the particular element of its surface involved pulls away from its plate, the capacity decreases and the potential of charge increases.

All the condenser plates are brought out to a commutator over which travel three brushes driven by a shaft, which also positively drives the drum in its rolling course. One brush, used for charging, is set to match the point of drum contact. The brush for the raised-potential discharge follows corresponding to a separation of the plates of about ⅛ in., while the third brush trailing after discharges any residual charge retained on the plates. Mercury jets properly controlled serve as brushes to guarantee perfect contact at the commutator, and air jets serve to keep the commutator free from excess mercury.

DISINFECTING DEVICES.

A disinfecting device is patented by Messrs. R. B. and Llewellyn Adams, of Waterville, Ohio. A vial is provided containing disinfectant and held in a special holder. A tube leads to the transmitter and a rubber bulb is furnished by means of which one may pump air charged with disinfectant within the mouthpiece.

Mr. E. H. Long, of Los Angeles, Cal., has found that there is an unsafe weakening of transmitter mouthpieces at the point of reduction where the thread for mounting is cut. To overcome this he has provided a metal nipple which carries the threads. The rubber mouthpiece is then formed about the end of this in a manner to securely retain it.

SERVICE METERING SYSTEM.

There have been a good many different devices and systems proposed for counting telephone calls, where message rate service is in vogue. Such arrangements have been commonly called service metering systems. However, this is a misnomer, as these systems are purely message counting or registering systems. A service metering system must properly record the duration of service, and that is exactly what is done in service recording devices described in three patents issued to Mr. R. H. Manson, of Elyria, Ohio, and assigned by him to the Dean Electric Company.

Three modifications are described in the patents. In one the record of service begins at the calling station, with the initiation of a call by the removal of the telephone from the hook. In the second, the calling station meter begins its record with the removal of the receiver at the called station in response to his signal. In the third system, the metering apparatus at both calling and called stations operates simultaneously to charge both, the beginning of the record occurring with the response of the called party and continuing until the disconnection of the calling party by the operator. In all three the recording mechanism is the same, namely, a constant-speed motor receiving current from the central battery through being included in the line circuit; a permanent field magnet, and a ratchet clutch for driving, the motor running idle in one direction and driving the recorder in the other. Reversal of rotation is effected by reversing the battery supply circuits.

CIRCUIT FOR BALLAST SYSTEM.

A cord circuit for ballast systems of switchboard working is described in a patent granted to Mr. C. D. Enochs. The patent, which has been assigned to the Vote-Berger Company, of La Crosse, Wis., refers to the control of the supervisory circuit. By a "ballast" system is meant a system wherein the lamp signals are connected directly to the line circuits instead of being included in local circuits. Compensation for variations of line resistance for stations at varying distances is then made by including "ballast" in the form of resistance, self-regulating within the required limits though its own temperature changes. In some instances a lamp may serve as its own "ballast."

In the present case, the supervisory lamp and an impedance coil are together shunted across the cord circuit whenever the plug corresponding is inserted in a jack. The lamp then glows as long as the line circuit is open. When this latter is closed at the hook switch, it by-passes sufficient current to shunt out the supervisory lamp. It must, of course, be known that the battery is connected to the cord circuit through retardation coils of considerable resistance. Therefore, when a shunt is placed about the lamp there is no considerable increase of total current, but merely a diversion of a large part of the existing current through the line circuit.

LETTERS TO THE EDITOR.

Proportioning the Resistances of Squirrel-Cage Rotors.

To the Editor of Electrical World:

SIR: In the design of a squirrel-cage secondary of an induction motor it is sometimes rather tedious to ascertain the best proportions of bars and end rings, especially if it is desired to limit the copper loss precisely to a certain value. The usual process is to calculate the e.m.f. induced in a bar and the current therein. The relation $\frac{e}{i} = R_t$ then gives the resistance required. Of this a certain amount, R_b is allowed for the bar and the remainder R_r for the two end rings. Under ordinary conditions it is best for a given value of R_t to proportion the cross-sectional areas A of the bar and s of the ring, so that the rings will have a greater resistance loss per unit of exposed surface than will the bars, owing to the greater facility with which the former can radiate the heat generated therein. Owing to the somewhat indefinite state of our knowledge of the capability of different surfaces to radiate heat, it would seem that a fairly good method capable of fulfilling the above condition with some degree of approximation might be derived from the condition for minimum copper volume. Latour has shown that the equivalent resistance R_r, which the two end rings add to that of each bar, can be represented by $\frac{2SDa}{\pi P^2 s}$,

in which S = number of rotor bars; D = diameter of rings; a = resistivity; P = number of poles, and s = cross-section of end rings. The resistance of each bar equals $R_b = \frac{la}{A}$, where l is the length of bars taken between centers of the end rings. The copper volume may be expressed quite closely by $V = 2\pi Ds + SlA$. The problem now is to find the values of s and A that will make V a minimum and still give $R_t = \frac{e}{i} = R_r + R_b = \frac{2SDa}{\pi P^2 s} + \frac{la}{A}$. This occurs when the condition, $\frac{dV}{ds} \cdot \frac{dR_t}{dA} - \frac{dV}{dA} \cdot \frac{dR_t}{ds} = 0$, is satisfied. Performing the differentiation indicated, there results,

$$-2\pi D \frac{la}{A^2} + Sl \frac{2SDa}{\pi P^2 s^2} = 0,$$

whence $\frac{A}{s} = \frac{\pi P}{S}$. Substituting this value in the expression for R_t and solving for s and A, respectively, there is obtained,

$$s = \frac{Sa}{\pi P R_t}\left(\frac{2D}{P} + l\right)$$

$$A = \frac{a}{R_t}\left(\frac{2D}{P} + l\right)$$

In some cases it may be more convenient to work with the watts lost in the secondary winding as a whole rather than the volts, ohms and amperes (per bar), as was done above, and for this case the formulas are:

$$s = \frac{S^2 a i^2}{\pi P W}\left(\frac{2D}{P} + l\right)$$

$$A = \frac{Sai^2}{W}\left(\frac{2D}{P} + l\right)$$

i here is the current per bar, and W is the secondary copper loss in watts.

Similarly, it may be shown that for the condition of minimum copper volume, $\frac{W_b}{W_r} = \frac{R_b}{R_r} = \frac{lP}{2D}$, where W_b = watts lost in bars and W_r = watts lost in end rings.

The derivation of these formulas is general, so that they can be used with both the English and metric systems.

The last formula can be used to determine the ring resistance R_r that must be chosen after R_b has been assumed in order to get a given total resistance R_t (the value of which has not been chosen previously) with the least possible copper. If later heating calculations show that either R_b or R_r is too great a part of the total resistance R_t for a satisfactory arrangement, a part of either one must be transferred to the other, and the proportions must then be chosen differently from those given by the formulas.

Poland, Ohio. Albt. F. Puchstein.

Hard-Rubber Dielectric for Wave Meters.

To the Editor of Electrical World:

Sir:—I note that in your issue of Jan. 13, in a report of a paper on "Wave Meters" read by me before the Wireless Institute of New York on Jan. 5, I am quoted as saying, in a description of the Marconi portable wave meter, that "the use of hard rubber dielectric is not advisable, since it makes the apparatus unsuitable for use even as a secondary standard." As I did not make this statement and have no reason for believing such to be the case, I shall be very greatly obliged if you will publish this letter in order to correct the wrong impression which the report has given in this connection. The accuracy of reports in the *Electrical World* is so well known that I am sure that you will be willing to allow me space to deny having made a statement reflecting on the value of the Marconi instrument, and also to say that I do not hold the opinion attributed to me in connection with the use of a hard rubber dielectric.

Elmhurst, L. I. L. R. Gleason.

[We regret very much the appearance of the inaccurate statement to which Mr. Gleason refers. The report was written from memory, and we can now confirm his denial of the criticism attributed to him.—Ed.]

Cost of Developing Central-Station Business an Investment Charge.

To the Editor of Electrical World:

Sir:—Referring to the editorial in your issue of Feb. 3, on "New-Business Promotion and Going Values," it is stated that much interest attaches to the attitude of the Public Service Commission of Wisconsin on this question. This commission, however, reached a decision in this matter some time ago in the Cashton Light & Power Company case, the Antigo Water case and the Marinette Telephone case. The commission has held in these cases that investment made in developing business must be taken into consideration in fixing values.

St. Louis, Mo. William H. Bryan.

Sir:—In an editorial in your issue of Feb. 3, 1910, on the subject "New-Business Promotion and Going Values," you refer to the attitude of the Railroad Commission of Wisconsin on this important question. The subject is one to which the Wisconsin commission has devoted particular study, in a manifest endeavor to reach a solution that would be fair to the public and to the corporations affected by a valuation of property.

The real fact of the matter, so far as the Wisconsin commission is concerned, is that it recognizes the cost of establishing the business as a proper capital charge. The commission, after careful consideration of a complaint concerning the electrical rates charged by the Menominee & Marinette Light & Traction Company, rendered a decision on Aug. 3, 1909, in which it held that "the value of a plant is made up of a reasonable cost value of the physical property used and useful in carrying on the business, and in many cases also of the cost of developing the business of the plant, as represented by the deficits during the development period." In this case the Wisconsin commission did not feel that it was in a position to state definitely just what loss was sustained during the early years of operation, but it appeared to have no hesitation in declaring that the cost of building up a business may be a necessary element which will demand and secure recognition.

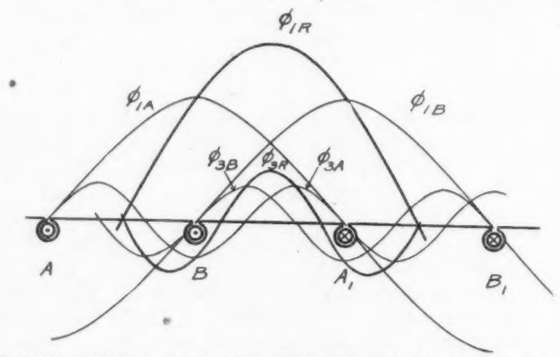
New York. James L. Vinton.

[We are very glad to print these corrections of the error that crept into the editorial to which our correspondents refer, particularly as the rational position of the Wisconsin commission on the subject discussed has been so fully reported in these pages.—Ed.]

Polyphase Magnetomotive Forces.

To the Editor of Electrical World:

Sir:—In connection with the letter by Mr. Henry Hermann in your issue of Dec. 30, 1909, attention should be called to the fact that the mode of e.m.f. generation in an induction motor is not the same as that in an alternator. Experiments have



Opposite Rotation of Fundamental and Third Harmonic Fluxes in a Two-Phase Motor.

shown conclusively that when the impressed e.m.f. is sinusoidal there are no harmonics in the counter e.m.f. wave in an induction motor. This fact has led many investigators to assume that the rotating field itself contains no harmonics, a conclusion which does not necessarily follow; the true explanation is that the

harmonics are present, but induce nothing but full frequency e.m.fs. The statement in the letter just referred to that "there is no such thing as one flux moving at a certain speed in one direction and another flux moving at a different speed in another direction" is incorrect, as the accompanying diagram will serve to show. The diagram shows the conditions existing in a two-phase motor at the instant when the currents are the same in both phases. The current in phase A produces a flux which contains the fundamental component ϕ_{1a} and the third harmonic component ϕ_{3a}; the current in phase B produces the components ϕ_{1b} and ϕ_{3b}; the resultants for both phases are the fundamental ϕ_{1r} and third harmonic ϕ_{3r}. At the chosen instant the current and fluxes of phase A are decreasing and those of phase B are increasing. It is evident that the increase of ϕ_{1b} and the decrease of ϕ_{1a} cause the fundamental resultant ϕ_{1r} to move to the right, and similarly the increase of ϕ_{3b} and the decrease of ϕ_{1a} cause the third harmonic resultant ϕ_{3r} to move to the left. In accordance with a well-known law, the fundamental resultant remains constant in value and moves at synchronous speed; a little consideration will show that the relations existing between the fundamentals ϕ_{1a} and ϕ_{1b} are duplicated in reverse order and to a one-third space scale by the relations existing between the harmonics ϕ_{3a} and ϕ_{3b}. Therefore, in accordance with the same law as that which applies to the fundamental, the third harmonic resultant remains constant in value and moves (backward) at constant speed equal to one-third of the synchronous speed.

This proof, in generalized form, would have been included in the article in the issue of Aug. 26, 1909, had not lack of space prevented; Table I and the context were derived from it, and any statement made there can be verified by drawing a diagram like the above. The writer is sure that a little study of the subject will convince anyone that the relations here expressed are correct.

CHICAGO, ILL. J. D. NIES.

Cold Bending of Large Iron Conduit.

To the Editor of Electrical World:

SIR:—Having originated the scheme for bending large iron conduit as described by Mr. George H. Westerman in the Jan. 20 issue and feeling that possibly the method may be utilized by some readers, it might be well to direct attention to some changes which practice has shown it to be expedient to make. The locomotive jack shown will not stand the work when bending conduit larger than 2 in. in diameter. The writer found it necessary to employ a hydraulic jack where conduit larger in diameter than 2 in. was to be bent, and to have blocks of very generous proportions to prevent crushing under the heavy strains imposed. The iron strap, also, about the grooved form must extend slightly beyond the flanges to prevent them from being broken off by the pipe. The strap should be of ⅝-in. iron and not less than 4 in. wide, with a ¾-in. bolt driven through a ¾-in. hole. It is essential that the bolt fit the hole tightly or the groove may break down over the bolt. The latter must be placed as near to the outer ends of the strap as possible without encroaching on the groove.

WATERBURY, CONN. GUION THOMPSON.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Safety Device for Transformers.—An illustrated description of a device of T. W. Partridge for safeguarding transformers against accidental connection between the primary and secondary. The device is shown in Fig. 1, while its application to a single-phase system is illustrated in Fig. 2, which shows a

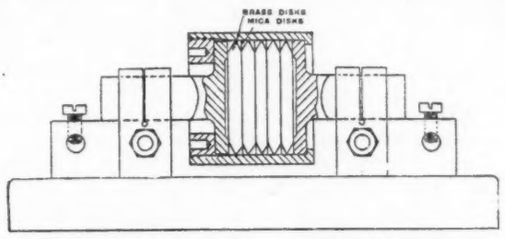


Fig. 1—Safety Device for Transformers.

single-phase generator with one pole earthed, supplying a concentric system. The transformer is shown connected to the end of a high-pressure feeder. The secondary of the transformer supplies a three-wire system, the neutral and the case of the transformer being earthed. If the transformer fails, the primary current will be earthed through either the case of the sec-

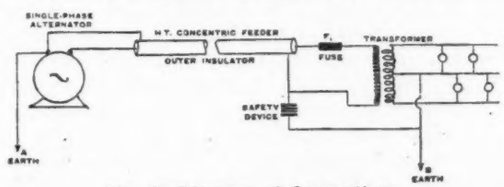
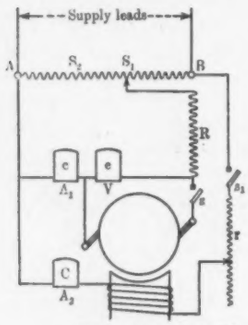


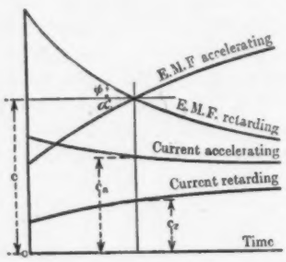
Fig. 2—Diagram of Connections.

ondary winding and the earth B. Provided the transformer is a small one, not exceeding, say, 50 kw, the current from earth B to earth A will probably operate the fuse or circuit-breaker F and so cut off the faulty transformer. If, however, the transformer is a large one, say, of 500 kw, the earth resistance will probably be too high to allow sufficient current to pass to operate the fuse or circuit-breaker F, especially as the latter is usually set to allow 100 per cent above the normal current to flow before acting. Under these circumstances the generator will continue to supply high-tension current through the feeder and the fault, the potential around the earthplate B being raised to a dangerous extent. Some means is required whereby the current can flow back to the generator in sufficient quantity to blow the transformer fuse F or to operate the circuit-breaker controlling the particular feeder. This is done by means of the safety device illustrated in Fig. 1, which is connected from the outer conductor of the concentric system to the earth wire B. It is not possible permanently to earth both ends of the outer conductor, or the safety device might be dispensed with. In this safety device the metal plates are separated by means of thin mica disks, perforated with four holes each. As soon as the potential between these plates rises above, say, 500 volts, the current jumps the air-space and the outer of the concentric system is connected to the inner through the fuse or circuit-breaker F and the fault, causing a short-circuit in the primary and blowing the fuse or operating the circuit-breaker at once and so isolating the transformer.—Lond. *Elec. Review*, Jan. 28.

Measuring the Moment of Inertia of a Direct-Current Armature.—G. KAPP.—The author first explains the brake method and the flywheel method of obtaining the moment of inertia of an armature. He then describes a new electrical method which has great advantages in the case of large machines. As no special apparatus is required, the method is inexpensive. The machine is run light as a motor, the connections to the constant-voltage supply mains being made as shown in Fig. 3. AB is a main current regulator and R a resistance, the value of which need not be accurately known. The field is magnetized from the mains and the excitation is regulated by a rheostat r. The ammeter A_2 measures the exciting current C, which should be kept as low as possible for full

speed and a reasonably small armature current c, which latter is measured on the ammeter A_1. The voltmeter V indicates the brush voltage e, and this for a low armature current may be taken as equal to the induced voltage, so that the product ec represents at any moment the available power or power absorbed by the armature. If the switch s is left closed and the slider on the main-current regulator be run back to point A, then the inertia of the armature will be the source of power not only to cover the normal losses, but also the ohmic loss in R. It will,





Figs. 3 and 4—Measuring Momentum of Inertia.

therefore, very quickly come to rest. But if we set the slider on the main-current regulator some distance from A, so that the armature receives power electrically, then we can prolong the time of running out to any desired degree and thus obtain any desired slope on the retardation curve. This permits of longer intervals between the readings and a correspondingly greater degree of accuracy. The excitation is kept constant throughout the test so that apart from a slight correction for armature and brush contact resistance (which can easily be made if desired) the brush voltage is proportional to the speed, or $e = u\beta$, where β is a coefficient depending on the excitation and is determined once for all by taking a speed and e.m.f. reading when the machine is running steadily. Let L now represent all the losses at a particular speed u, then the power equation for that speed is

$$ec = L + \frac{388}{\beta^2} eI \frac{de}{dt}$$

By manipulating the main-current regulator, or simply a rheostat put in series with the armature, which can be lengthened and shortened so as to slow down or speed up the machine, we can make two runs at the same excitation—one to get retardation, the other to get acceleration of the armature. By plotting the observed voltage and current against time we get the curves shown in Fig. 4. Let e be the e.m.f. at the crossing point and let the corresponding values of the currents c_r for the retardation curve and c_a for the acceleration curve. The tangents to the curves for e at the crossing point give the volt gradients, that for the retardation curve being negative. We thus get the equations $ec_r = L - \frac{388}{\beta^2} eI \tan\phi$ and $ec_a = L + \frac{388}{\beta^2} eI \tan\alpha$, from which it follows that $388\,I\,(\tan\alpha + \tan\phi) = \beta^2\,(c_a - c_r)$. The special case that $\phi = 0$ and the retardation curve is a straight line means that the machine is running steadily taking c_0 amp to drive itself. In this case $388\,I \tan\alpha = \beta^2\,(c_a - c_r)$. Thus the test is reduced to one steady run at e volts, by which β and c_0 are found, and an acceleration run during which observation of voltage and current as a function of time must be taken. The observations need, however, only be taken over a limited range from a little below e to a little above eI; only sufficient to draw the tangent to the e.m.f.-time curve accurately.—Lond. *Electrician*, Jan. 21.

Dynamo Brushes.—A note on a recent British patent of F. W. Carter (3352, 1909; Jan. 6, 1910). Brushes for high-speed machines are shaped at the trailing edge, so that the area of contact between brush and segment during the last moments of commutation decreases at a slower rate than that due to the movement of the segment when brushes with parallel sides are used. The brushes are fluted or corrugated on the trailing edge so as to provide teeth with rounded edges, or rectangular brushes may be staggered with respect to the commutator to give the same effect.—Lond. *Elec. Eng'ing*, Jan. 13.

Single-Phase Commutator Motor.—A note on a recent British patent of Siemens Brothers Dynamo Works (20,005, 1909; Jan. 13, 1910). To improve the speed characteristic of a single-phase shunt or separately excited commutator motor, an auxiliary winding is provided on the stator. This winding replaces the ordinary compensation winding and is supplied from an auto-transformer with an e.m.f. of such magnitude and phase that the e.m.f. of self-induction in the armature winding is neutralized by transformer action.—Lond. *Elec. Eng'ing*, Jan. 20.

Eddy-Current Losses.—F. Rusch.—The first part of a mathematical paper on the eddy-current losses in the copper conductors of alternating-current armatures.—*Elek. und Masch.* (Vienna), Jan. 23.

Lamps and Lighting.

Metallic-Filament Lamps.—C. Cheneveau.—A summary of various recent researches on metallic-filament lamps. The relation between power and voltage or between candle-power and voltage has been studied by Laporte, Steinmetz, Berninger, Jolley, Ives and Woodhull. The second part of the article deals with the relation between luminous intensity and absolute temperature or between luminous intensity and power. The following table is a summary of measurements of the temperature of various lamps under normal operation. The temperatures are given in the absolute temperature scale.

Authority.	Year.	Material.	Deg.
H. F. Weber	1892	Carbon	1838–1853
P. Janet	1898	"	1883–1893
Lummer and Pringsheim	1899	"	1875–2100
Le Chatelier and Boudouard	1900	"	2073
Waidner and Burgess	1906	"	1950
"	1906	Tantalum	2000
"	1906	Tungsten	2300
Cherici	1907	Carbon	1950
"	1907	Tantalum	2000
"	1907	Tungsten	2300
Grau	1907	Carbon	1933
"	1907	Tungsten	2123
Morris, Stroud and Ellis	1907	Tantalum	1850
"	1907	Tungsten	2000
W. W. Coblentz	1909	Metallized cabon	1843
"	1909	Tantalum	1943
"	1909	Tungsten	2083

The recent investigation of Fery and Cheneau is summed up and it is stated that there is a simple formula giving the luminous intensity as a function of the consumed watts whatever the nature of the filament of the lamp. The general form of this relation is

$$I = Ae^{-\frac{B}{x\sqrt{w}}}$$

where A and B are constants characteristic of each lamp. $x = 4$ for the carbon filament and $x = 4.6$ for the metallic filament, at least as a first approximation.—*La Revue Elec.*, Jan. 15.

Metallic Filaments.—The first parts of a review of recent progress in metallic-filament manufacture. A general outline of the chief principles and difficulties in the production of metallic filaments is given, followed by brief descriptions of various special improvements based on German patent specifications. A filament of Siemens & Halske containing a core of tantalum and a cover of tungsten is mentioned; also several other methods of this company for drawing tungsten filaments. One method consists in stamping tungsten powder into the inside of a ductile tube of steel which is then rolled or drawn, and the steel removed afterward. In another method nickel tungstate is used as starting material, which is very ductile. The tungstate is finally subjected to a reduction process so as to obtain pure tungsten, while the nickel is evaporated by electric heating.—*Zeit. f. Beleucht.*, Jan. 10 and 20.

Tungsten Filament.—A note on a recent British patent of W. D. Coolidge (282, 1909; Jan. 20, 1910). Filaments squirted from a mixture consisting of tungsten powder and a binding agent of cadmium, mercury and bismuth are baked in the presence of a gaseous reagent, such as hydrochloric acid, chlorine or hydrogen sulphide, in order to dry them. The chemical compounds formed are removed during the sintering treatment. An alternative method consists in baking the wires in a pack-

ing of metallic powder, which combines with the mercury and cadmium. These processes are said to prevent the formation of globules of the molten binding agents on the surface of the filament during baking.—Lond. *Elec. Eng'ing*, Jan. 27.

Lighting of Weaving Mill.—L. B. MARKS.—The old mill of a weaving company was lighted by a strictly localized lighting system, each loom being equipped with two 16-cp carbon lamps and reflectors, this resulting in "spotted lighting." In the new mill of the same company it was decided to install an entirely different system in which the distribution of illumination over the working surfaces of the loom is very uniform. The general lighting effect is much superior and the consumption of power is greater even with metallic-filament lamps, but the additional cost of the new lighting system is expected to result in ultimate economy.—New York *Ill. Eng.*, February.

Flicker Photometer.—J. S. DOW.—A paper read before the (British) Physical Society on the physiological principles underlying the flicker photometer. The author describes experiments showing that the "Purkinje" and "yellow-spot" phenomena are much less marked when using a flicker photometer. He suggests that the explanation is due to the fact that the "rod" elements in the retina receive a luminous impression more slowly than the "cone" elements, and also retain it longer. —Lond. *Electrician*, Jan. 21.

Generation, Transmission and Distribution.

Gas Plant.—HENRY.—An article on gas plants utilizing blast-furnace gas and coke-oven gas. To get the necessary uniformity of speed alternators are preferable to direct-current dynamos. In general, three-phase alternators with revolving field are employed and the design in which the revolving field represents the outer part of the machine seems to have found special favor in Europe.—*L'Industrie Elec.*, Jan. 25.

Reduction Gear for Steam Turbine.—G. WESTINGHOUSE.—Under the title "Broadening the Field of the Marine Steam Turbine" the author gives an historical review of the development of the Melville and Macalpine reduction gear for steam turbines, with description and illustrations.—*Elec. Jour.*, January.

Turbo-Generators.—E. J. BRUNSWICK.—A discussion, illustrated by diagrams, of the chief principles of construction of different types of steam turbines.—*L'Industrie Elec.*, Jan. 25.

Traction.

Tramway Supply from Central Stations.—H. E. YERBURY.—A paper read before the Manchester Section of the (Brit.) Inst. Elec. Eng. in which the author criticized the usual methods of allocating the relative proportions of generating costs in combined lighting, power and tramway stations, when determining the charge to be made for energy supplied to the tramways department. A detailed comparison was made between the total fixed costs of 1.73 cents per unit assumed chargeable to the tramway department at Manchester, and a figure of 0.742 cent obtained in the independent tramway station at Sheffield. The assumption that the difference is justified by the expense incurred in providing plant for the tramway peak load, and in conversion from alternating current to direct current was characterized as incorrect. It was suggested that the charge should be based on capital and running costs in connection with the plant essential to the tramway supply only, with the addition of a profit of from 3 per cent to 5 per cent on the running cost. In the discussion Pearce justified the charges determined at Manchester; J. R. Salter asserted that many lighting stations actually owed their existence to the tramway departments.—Lond. *Elec. Eng'ing*, Jan. 27.

Electric Traction Statistics.—G. F. Wells discusses the stability of electric railway and light earnings and gives especially figures of the better earnings of electric street railways as compared with steam railways. E. S. Webster comments on the electric railway situation and thinks that the problem of securing an adequate revenue from passenger fares appears to be the most serious issue now confronting the electric railway industry. L. H. Parker discusses the average haul and the critical haul (the maximum distance for which passengers may ride for a nickel with neither profit nor loss to the railway company on electric railways). A. S. Michener gives figures on street railway earnings during the business depression of 1907-08.—*Stone & Webster Public Service Journal*, February.

Gasoline-Electric Motor-Boats.—A note on some motor-boats with combined petrol and electric drive which have been constructed in Germany. A storage battery is charged at low speeds by a dynamo which is driven as a motor to assist the engine at high speeds. A 17-ft. cruising boat of this type, displacing over 9 tons, carries a 20-hp engine, a dynamo and an 80-cell battery with a capacity of 213-amp-hours on the one-hour discharge rate.—Lond. *Elec. Eng'ing*, Jan. 20.

Propulsion of Vessels.—W. L. R. EMMET.—A paper read before the Society of Naval Architects and Marine Engineers of New York. The author describes two systems of electric propulsion. In the first a low-pressure turbine and an electric motor are fitted on each propeller shaft, current being supplied to the motor from a turbo-generator, and the low-pressure turbine being only used at high vessel speeds and for reversing. In the second system the whole power is delivered to the propeller shafts by means of electric motors.—Lond. *Electrician*, Jan. 28.

Monorail Traction.—A. PÖPPL.—A theoretical investigation of the application of the gyroscopic principle to single-rail traction. The discussion is chiefly based on the experience obtained in the use of the gyroscope for increasing the stability of ships. —*Elek. Zeit.*, Jan. 27.

Portable Substations.—H. MARCHAND.—A discussion of the advantages of portable substations, placed on cars, for tramway systems.—*L'Industrie Elec.*, Jan. 25.

Installations, Systems and Appliances.

British Central Stations.—The annual statistical tables giving details of the connections to stations taking the supply in bulk and connections to stations having a combined lighting and traction load. In a separate article a summary of the present situation is given. For the first time the connections to provincial stations exceed 1,000,000 kw. The principal figures of the connections to electricity supply stations in London and provinces and of the use of direct current, alternating current, or mixed direct and alternating currents are given in the following table:

London (348,111 kw)	Municipal (108,621 kw)	direct current	52,871 kw
		alternating current	31,308 kw
		mixed current	24,442 kw
	Companies (239,490 kw)	direct current	73,481 kw
		alternating current	34,422 kw
		mixed current	131,587 kw
Provinces (1,013,157 kw)	Municipal (839,497 kw)	direct current	350,780 kw
		alternating current	117,307 kw
		mixed current	371,410 kw
	Companies (173,660 kw)	direct current	78,995 kw
		alternating current	16,429 kw
		mixed current	78,236 kw

The municipally owned stations are predominant in the provinces, while in London the reverse is the case. The figures for connections in kilowatts are given as follows:

	Municipal	Company	Total
London	108,621 kw	239,490 kw	348,111 kw
Provinces	839,497 "	173,660 "	1,013,157 "
Total	948,118	413,150	1,361,268

The connections to the "power companies" have grown rapidly during the last few years. The figure for 1908, namely, 158,780 kw, is changed to 219,644 kw.—Lond. *Electrician*, Jan. 28.

Distribution of Energy to Small Consumers.—A note stating that the Fixed Price Light Company has arranged with the London Electric Supply Corporation to take electricity in bulk and to distribute it to the hundreds of small houses to be found in the supply area of that corporation. The company proposes to provide all wiring, lamps, etc., and to give a supply to a number of houses from a single service and meter. A fixed price per lamp installed—averaging 6 cents per week—will be charged, and no charge will be made for the current supplied, provided that the light is used reasonably. A tariff of this nature has been tried without any great success, but metallic-filament lamps have so altered the problem of electricity supply that the scheme of the Fixed Price Light Company now seems feasible. The first installment of lamps is supplied free of charge by the company, while renewals have to be purchased by the consumers, who are thus encouraged to use the light

economically, or, at any rate, not wastefully. To reduce the cost of wiring it is proposed to use "stannos" wires, and employ the metal covering as the return, whereby the total cost per outlet, including a metallic-filament lamp, has been reduced to below 20 cents. The use of a grounded concentric system is rendered possible by the installation of a small ordinary double-wound transformer. This transformer also enables the supply pressure to be reduced so that low-voltage metallic-filament lamps can be employed. These lamps are, of course, cheaper than those for higher voltages, and also possess the advantage of allowing smaller lighting units where desired. The cost of services is reduced to a minimum by supplying a whole block of houses from a single service, and the cost of operation is reduced as no meter reading is necessary for the individual consumers.—Lond. *Electrician,* Jan. 21.

Electric Equipment of Hotel.—M. Arbeiter.—An illustrated description of the electric equipment of a mountain hotel in the Alps, where the transportation difficulties for the fuel are important. Power is generated by means of an 8-hp gasoline engine coupled to a direct-current generator, which works in combination with a storage battery giving 108 amp-hours when discharged in three hours. The hotel contains 180 metallic-filament lamps and the economy of the gasoline-electric set is pointed out.—*Elek. und Masch.* (Vienna), Jan. 23.

Rating of British Central Stations.—The first article of a serial on electrical undertakings and the law of rating. This article deals with the rating of electric lighting and power companies with respect to the British law of rating property for the relief of the poor.—Lond. *Elec. Review,* Jan. 21.

Wires, Wiring and Conduits.

India Rubber for Insulation.—I. W. Henry.—An article on the use of india rubber-insulated cables in the United States. The increase in the use of india rubber for insulating purposes during the last 20 years is indicated by the fact that at the beginning of that period there were only five insulated-wire companies in America with an aggregate output of under $3,000,000 per annum, while now there are at least 20 manufacturers with an aggregate output exceeding $25,000,000. The method of covering the conductor with rubber which was adopted by the earlier American companies was that employed in England, and consisted in laying two longitudinal strips of rubber, one above and one below the conductor, and pressing them around the conductor and making longitudinal joints by passing the conductor and rubber strips between semicircular rolls, but a little later another method was largely adopted in the United States, in which the rubber was fed into a screw machine, which forced it in a compact and seamless mass around the conductor as it emerged from a die. This method, although in regular use in England for coating conductors with gutta-percha, has never been largely used there for putting on rubber insulation, but it has proved very satisfactory in America, where it has been used, not only for the manufacture of lighting cables, but also for making the core of submarine cables. Rubber-insulated cables have proved their value, both for land lines and for submarine work under extreme conditions of temperature, either in tropical or semi-arctic regions, and may become a more serious rival than heretofore to the gutta-percha cable as soon as the price of rubber falls to a more moderate figure.—*India Rubber World,* Jan. 1; Lond. *Elec. Review,* Jan. 21.

Electric Cables.—F. Fernie.—The first part of an illustrated serial on transmission cables. The author discusses paper-insulated, lead-sheathed cables, and deals especially with the paper insulation and the oil used for impregnating the paper.—Lond. *Electrician,* Jan. 21.

Protection Against High-Frequency Currents.—A. Soulier.—An illustrated article on the protection of networks against the effects of high-frequency currents. The author describes the Mosciski glass-tube condenser, the Giles valve and the electrolytic condenser.—*L'Industrie Elec.,* Jan. 25.

Testing of Rubber.—A. Schwartz.—A paper read before the Manchester Section of the (Brit.) Inst. Elec. Eng. describing a machine for testing rubber. Its object is to effect the extension of the rubber by means of a load which is increased at a given rate until either a given load or a given extension is attained. When this point is reached the load is diminished at the given rate and the rubber is allowed to retract, the relation between load and elongation being recorded automatically throughout the test. The "hysteresis loop" thus obtained furnishes a graphical record of extension of the rubber test piece as the load is increased from zero to a given maximum, and decreased again to zero. The information regarding the physical qualities of the rubber that can be gained from the hysteresis loops is pointed out, and the effect of variation in temperature and in speed of working is mentioned. Numerous tests made to discover the behavior of rubber under various conditions are also described, while, in conclusion, the author discusses how the quality of the rubber may be discriminated by such tests, and the suggested lines for tests on standard material are considered.—Lond. *Electrician,* Jan. 21.

High-Tension Insulators.—K. Kuhlmann.—A continuation of his long illustrated article giving details of construction of various types of high-tension insulators.—*Elek. Zeit.,* Jan. 27.

Electrophysics and Magnetism.

Iron-Copper Alloys.—C. F. Burgess and J. Aston.—An account of an experimental investigation of the magnetic and electric properties of iron-copper alloys. There is no advantage to be gained in adding copper to iron if a good magnetic permeability is wanted. The quality deteriorates almost in proportion to the added copper content. On the other hand, there is nothing to be feared from the effect upon the magnetic quality of the small percentages of copper ordinarily found in commercial materials. The variation of electrical conductivity with the content of copper is also discussed.—*Met. and Chem. Eng'ing,* February.

Electric Properties of Steel.—H. Pecheux.—A paper read before the French Academy of Science on the electric resistivity and thermoelectric properties of carbon and silicon steels. Four different steels were tested. The following formulas give the resistivity in microhms per centimeter cube as function of the temperature t in deg. C.:

Soft steel (3 per cent C, traces Si):
resistivity $11.75\ (1 + 0.0065\,t + 0.0000043\,t^2)$.
Steel (4 per cent C, 0.1 Si):
resistivity $13.50\ (1 + 0.0037\,t + 0.0000074\,t^2)$.
Steel (6 per cent C, traces Si):
resistivity $11.25\ (1 + 0.0049\,t + 0.0000089\,t^2)$.
Hard steel (8 per cent C, 0.1 Si):
resistivity $15.42\ (1 + 0.0040\,t + 0.0000054\,t^2)$.

Some notes on the thermoelectric properties of these steels are also given.—*L'Industrie Elec.,* Jan. 25.

Heating of Wire by Oscillatory Discharges.—A. Leaute.—A note on a French Academy paper on a mathematical study of the heating of a conductor through which a very rapid oscillatory discharge passes. The author has formerly shown that the discharge of a condenser through a very thin metallic wire produces in certain cases an explosion of this wire. This explosion is the stronger, the smaller the self-induction of the circuit. The reason is that a reduction of self-induction causes an increase of the damping coefficient and of the amplitude of the current.—*L'Industrie Elec.,* Jan. 25.

Non-Newtonian Mechanics.—H. Poincare.—A very interesting lecture before the French Association for the Advancement of Science on the principles of the "new mechanics" as distinguished from the old Newtonian mechanics. This development has been suggested by the electric theory of matter. The author deals especially with the principle of relativity and its consequences.—*La Revue Elec.,* Jan. 15.

Electrochemistry and Batteries.

Acetylene Tetrachloride.—J. H. Vogel.—A report of the present situation of the calcium carbide situation in Europe. The manufacture of acetylene tetrachloride is now carried out on a commercial scale in various plants in Germany. This is an excellent solvent and is used as a substitute for benzine and like materials, its great advantage being its non-inflammability.

—*La Revue Elec.*, Nov. 15, 1909; abstracted in *Met. and Chem. Eng'ing*, February.

Electric Furnaces.—G. FLUSIN.—A review of the present status of electric furnace industries in France. The author deals especially with calcium carbide, electric steel refining and fixation of atmospheric nitrogen.—*La Houille Blanche*, January.

Units, Measurements and Instruments.

Frequency Meter.—An illustrated description of a frequency meter made by a French company. The principle is shown in Fig. 5. *B* and *B'* are two coils with soft steel cores *F F* sus-

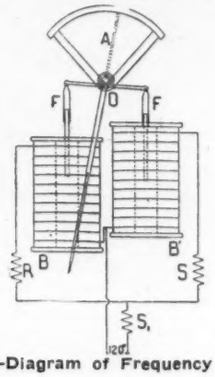


Fig. 5—Diagram of Frequency Meter.

pended in the inside. The coil *B* is in series with a resistance *R* and the coil *B'* with a self-induction *S*. The tractive force of the magnet coil *B* on its core is proportional to the deflection α of the needle *A* from the vertical position, while the tractive force of *B'* on its core is inversely proportional to the deflection α. If *R* is a non-inductive resistance and *S* has a resistance negligible compared with the self-inductance, the deflection is directly proportional to the frequency. However, since the above conditions are not fulfilled in practice this is not exactly true and the relation between frequency and deflection is not represented by a straight line. The deflection is independent of the variation of the voltage and gives directly the frequency. —*La Houille Blanche*, January.

Measuring Wave-Length.—A. CAMPBELL.—A paper on the measurement of wave-length for high-frequency electrical oscillations. The author gives results of tests of wave meters at the British National Physical Laboratory. Within the limits of wave-length used, the wavemeter with coils of well-stranded wire gave results in close agreement with theory, while in the case of the instrument with coils of solid wire the agreement was as close as could be expected, as the correcting formulas are only strictly applicable to long solenoids.—Lond. *Electrician*, Jan. 21.

Analysis of Wave-Form.—H. HERMANN.—The conclusion of his article on distorted voltage and current waves and their analysis. The analysis of the usual wave-forms occurring in alternating-current practice is rendered quite easy by means of simple formulas.—*Elek. Zeit.*, Jan. 27.

Telegraphy, Telephony and Signals.

Telephone Exchange.—An illustrated description of the common-battery exchange recently put into operation at Fremantle (Western Australia). An intermediate distributing frame of the vertical type is employed; alternate verticals are used for local and multiple connections. Some of the subscribers' sets are fitted with a special party-line lock-out device.—Lond. *Elec. Eng'ing*, Jan. 20.

Condenser Telephones.—C. K. ORT AND J. RIEGER.—A translation of their recent German paper on the use of condenser telephones.—Lond. *Electrician*, Jan. 21.

Miscellaneous.

Russia and Siberia.—S. W. CUTTRISS.—The author urges that the conditions of electrical development in Russia and Siberia should not be lost sight of since an unprecedented boom is expected for the next few years. At present Germany does the largest part of the electrical business in Russia. The industry is still very little developed. In the Russian empire there are 30 cities which possess an electrical tramway system, and among the 1802 towns there are only 886 lighted at all. Of these 74 are provided with electric light and 35 with gas. In Central Asia electric light is unknown and in Siberia one city only is lighted by gas and five by electric light. In the Caucasus and Vistula districts oil lighting is employed. Among the 224 towns in these districts this system is adopted by 172, while only 11 are provided with electricity and 11 with gas. In Eastern Russia there are 762 towns, of which 57 are lighted by electricity, 23 by gas, 631 by petroleum and 120 have no municipal lighting system at all. The profits of electric stations, on the other hand, seem very good. The net profits of the works of the city of Vilna were 50 per cent; Vologda, 39 per cent; Minsk, 33 per cent; Orenburg, 44 per cent; Poltava, 49 per cent; but it is not stated whether capital charges have been included in arriving at the above results. Some data are given on the electrical equipment of Ekaterinbourg, a city in the Ural Mountains. The equipment is quite up to date, and metallic-filament lamps are freely used. The price charged is 20 cents per kw-hour. The telephone is almost unknown in Russia, being adopted in only 15 cities.—Lond. *Elec. Eng'ing*, Jan. 27.

Electro Bank.—E. WALCH.—An account of the history of the Bank for Electrical Enterprises, in Zurich, which is commonly known as the Electro Bank. It was founded in 1895 with a capital of $6,000,000. It has financed various lighting stations, traction systems, transmission plants and electrochemical works in Italy, Spain, Germany, Switzerland and France, chiefly those in which the Allgemeine Elektricitäts Gesellschaft supplied the machinery. The bank has been quite successful. Dividends during the last five years were 8½ per cent, 9 per cent; 9½ per cent, 10 per cent and 10½ per cent.—*Elek. Zeit.*, Jan. 27.

Lord Kelvin.—J. A. EWING.—A lecture held before the (Brit.) Inst. Elec. Eng. on the work of Lord Kelvin in telegraphy and navigation.—Lond. *Electrician*, Jan. 21.

New Apparatus and Appliances

FIELD RHEOSTATS WITH REMOTE CONTROL.

The location of hand-operated rheostats becomes difficult as the size increases and finally a point is reached where remote control is practically necessary. The General Electric Company has put on the market a type of remote control for rheostats, for which it claims certain advantages over motor control.

The details of the construction of this device and the manner of operating it are shown in Figs. 1 and 2. The rheostat arm is rigidly fastened to a wheel with a toothed rim. Pawls fastened to the common core of the two magnets *AA*, Fig. 2, engage the toothed rim of the wheel mentioned above and move it clockwise or counter-clockwise. To cut resistance into the field circuit the double-pole switch *B* is closed to the left, thus energizing the left-hand solenoid and causing the left-hand pawl to engage the rim of the wheel, moving it in a clockwise direction.

When the solenoid core has reached its extreme point of travel, the solenoid circuit is automatically opened by the small switch *C*, allowing the pawl to be returned by a spring to the position midway between the solenoids and permitting the switch *C* again to close, starting anew the cycle of operations just described. This cycle of operation is repeated over and over again until switch *B* is opened. To cut out the re-

sistance switch *B* is closed to the right, causing the same cycle of operations as described above with the exception that the right-hand solenoid is energized and the arm is driven counter clockwise. Each end of the switch dial is provided with a limit switch, *D*, which is automatically operated by the switch arm opening the circuit of the solenoid when the resistance is entirely cut in or out, in this manner protecting the apparatus in case the solenoid is left energized when the arm has reached its extreme point of travel. It also prevents unlimited motion of the arm in case the operator leaves the switch *B* closed.

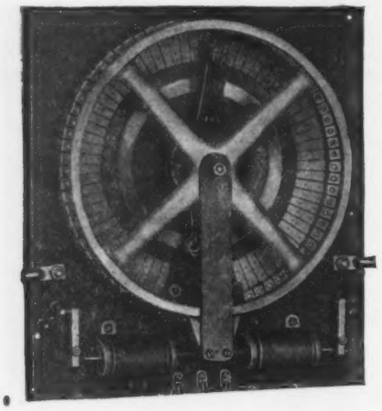


Fig. 1—100-Amp Ratchet-Driven Field Rheostat Switch.

The device is dead-beat, as there are no high-speed revolving parts which, due to their inertia, continue to cut in resistance after the controlling circuit has been opened. As compared with motor-operated rheostats, there are claimed for this device the following advantages: Less cost, closer regulation of resistance, minimum attention, less space, is lighter in weight, and can be made self-contained. Repairs are much simpler and can be more quickly made, and the cost of maintenance is less.

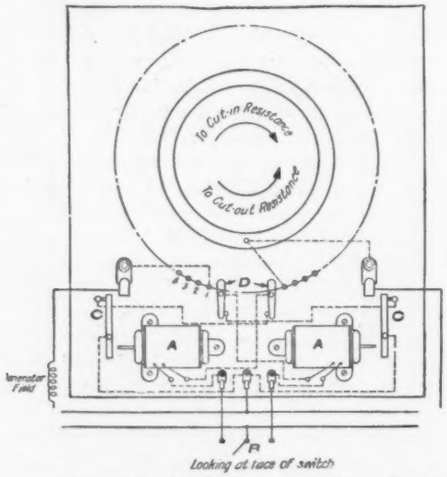
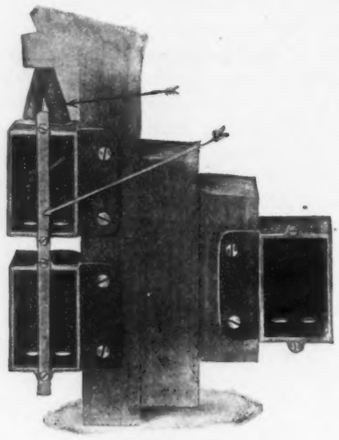


Fig. 2—Connections of Remote Control Field Rheostat.

SWITCH BOX.

The Newhub Electric Company, of Akron, Ohio, has brought out the switch box illustrated herewith. The feature of the box is that it possesses a flange on one side by means of which it may be attached to the studding and thus have a firm support. The flange is set a sufficient distance below the face of the box so as to bring the latter flush with the plastered surface of the wall.

By the employment of a spacing tool, the use of which is indicated in the engraving, the boxes may be set in gangs and covered by a single switch plate arranged parallel with the joist and not in a plane at right angles to it as is ordinarily found. The seal used in closing the openings in the box may also be employed to clamp the conduit, and where it is desirable to place boxes between studding, the intervening space may be built up with blocks, as indicated on the right side of the engraving. The device is said to have the approval of the Underwriters.



Switch Box.

BATTERY-CHARGING RHEOSTATS.

The wide application of storage batteries as a source of energy for electric automobiles, launches, etc., has made it imperative that means be provided for quickly charging them, and that the apparatus be so simple that the charging may be done by any one. The owner may then charge his own battery on his own premises.

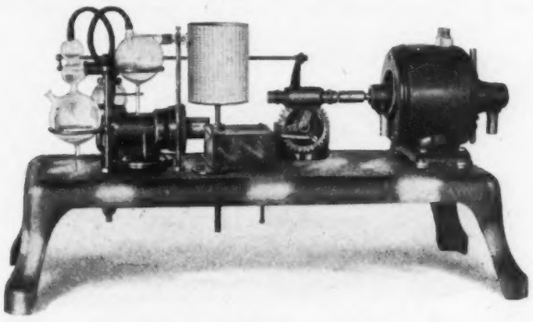
Wherever a 125-volt direct-current circuit is available the result may be easily accomplished without employing expensive apparatus by the use of the battery-charging rheostat, shown herewith. It is simple in mechanical construction, of rugged design, and has a maximum current carrying capacity amply sufficient to meet all conditions of service.

Battery-Charging Rheostat.

In order to prevent any possibility of accidental contact with live parts, the rheostat is insulated and enclosed by a cover so constructed as to permit of thorough ventilation. These rheostats are very compact, present a neat appearance, and may be installed in any place. Special pains were taken to make all parts readily accessible for inspection and repairs. These rheostats are made by the General Electric Company, Schenectady, N. Y.

AUTOMATIC SMOKE RECORDER.

At the recent Chicago Electrical Show the Eddy automatic smoke recorder, illustrated herewith, was connected with the Coliseum chimney, and the practical demonstration of its operation was a constant source of interest to those who have to burn coal under the eye of an officer from the smoke inspector's department. Recording, as it does, the time, duration of time and the density of each puff or long-drawn-out smother of smoke, the card for the day presents a graphic story of the work of the fireman in his efforts to make his furnaces live up to the standard.



Automatic Smoke Recorder.

The principle upon which the instrument is operated is quite simple. A sample of the gas is drawn through a brass tube from the uptake, breeching or chimney and driven against a card mounted on a revolving drum. The coloring matter (soot) carried along in the gas is left on the card and forms the record. The flow of gas is actuated by a small motor-driven pump of the outside packed plunger type. The gas is dried by passing it through a condenser and over the surface of sulphuric acid.

Besides being of assistance in the burning of bituminous coal smokelessly, men versed in the burning of oil pronounce the smoke recorder valuable, for smoke coming from an oil furnace is indicative of poor combustion and serious loss. Not a few owners of large steam power plants keep a man on the roof with a telephone connection to the fireroom to warn the men in charge of the furnaces of the presence of smoke. The value of a smoke recorder under such circumstances is obvious. The instrument is manufactured by the Hamler-Eddy Smoke Recorder Company, 3906 South Halsted Street, Chicago.

PORTABLE TESTING STORAGE BATTERY.

The accompanying engravings illustrate a practical form of storage battery for testing purposes manufactured by E. Marcuson, 136 Liberty Street, New York, under the name of the Witham portable testing battery.

Fig. 1—Portable Testing Storage Battery.

The cells are very small and are mounted in boxes to form batteries of any required voltage. The accompanying illustration is from a photograph of a 100-volt battery, the dimensions of the box being 10¾ in. x 5⅜ in. x 6¼ in., and the weight 16½ lb. Two other standard sizes are made at present—for 168 volts and 256 volts—which weigh 27 lb. and 40 lb., respectively. A special commutating switch permits of charging the batteries from 110-volt direct-current mains.

Fig. 1 shows a single cell and two elements. The outer glass tube is filled with paraffine oil, which effectually prevents surface leakage between cell and cell. The elements, containers, separators and electrolyte are all visible, accessible and removable; nevertheless, the battery is of an entirely portable character. It is claimed that, with a reasonable amount of care, the elements will last a number of years, and that, as all parts can be renewed by any one with ease in a few moments, there is no need to send a battery to the factory for repairs.

Besides its utility in potentiometer work, calibration of instruments, insulation tests, etc., the Witham battery has been found very convenient for making continuity tests of an electric-lighting installation before the mains are connected; for, since the internal resistance of the cells is low, high rates of discharge are possible, and an 8-cp or a 16-cp, 110-volt lamp can be fully incandesced for a considerable time.

The present simple form of the battery illustrated is stated to be the result of more than 10 years' experience with this particular type. During the past 12 months they have been adopted by the Interborough Rapid Transit Company, the New York Edison Company, the United Electric Light & Power Company, the Postal Telegraph-Cable Company among others. No particular difficulty is experienced in shipping the battery, which has been sent to such distant points as Portland, Ore., and San Francisco, Cal., where they are now being employed in testing work. It is claimed that the cost of these batteries is only a fraction of that of most other forms of battery used for similar purposes.

Fig. 2—Portable Testing Storage Battery.

An idea of the size of the batteries will be gained from the illustration, which shows a man carrying a 100-volt and a 500-volt battery.

INGERSOLL-RAND MANAGERS' MEETING.

The annual conference of managers and agents of the Ingersoll-Rand Company was held in New York and at the company's shops from Feb. 1 to 5, inclusive. The meetings were presided over by Mr. W. L. Saunders, president, and other executives in attendance were: Messrs. George Doubleday, first vice-president; J. P. Grace, vice-president; George R. Elder, vice-president; W. R. Grace, vice-president and treasurer; F. A. Brainerd, secretary; Henry Lang, director.

The sales organization was headed by H. H. Jowett, general manager of sales, while the shops were represented by F. W. Parsons, manager of the Painted Post and Athens shops, and William Prellwitz, chief engineer of the Easton and Phillips-

burg works. The heads of departments from the home office in New York were present, and the general sales force was represented by managers and agents from all the domestic offices and several of the foreign offices.

Leaving New York by private car on Tuesday morning, the party passed en route through the Musconetcong tunnel, the first railway tunnel in America driven entirely by machine drills, the rock drills used in this work having been built by one of the pioneer companies now comprising the Ingersoll-Rand Company. The first day was spent at the Easton, Pa., plant, examining the line of compressors, stone channelers, hammer drills, core drills, and pneumatic tools built in these shops. The second day was devoted to the Phillipsburg, N. J., works, inspecting the rock drills, electric-air drills, coal cutters and large compressors, which are the products of this plant.

A special train conveyed the party to the Painted Post, N. Y., shops, where Thursday was given to an exhibit of the compressors, rock drills, hammer drills, pneumatic tools and pneumatic hoists produced at this plant and at the Athens, Pa., shops. Returning to New York by special train, Friday and Saturday were occupied by business meetings at Hotel Astor. The social features of the conference closed on Friday evening with a banquet and theater party.

The number in attendance varied between 40 and 50. Among the foreign representatives present were Conrad Bollinger, from the London office; F. A. Choffel, Paris manager; Nichols Romeo, Milan, Italy; Victor M. Braschi and Juan Cuyas, Mexico City, and E. W. Gilman, of Montreal, vice-president Canadian Rand Company, Ltd.

NO-VOLTAGE RELEASE OIL CIRCUIT-BREAKERS.

For controlling eight large 6600-volt Westinghouse three-phase induction motors ranging over capacities of 3200, 2500, 2000 and 650 hp, in the new merchant mills of the Indiana

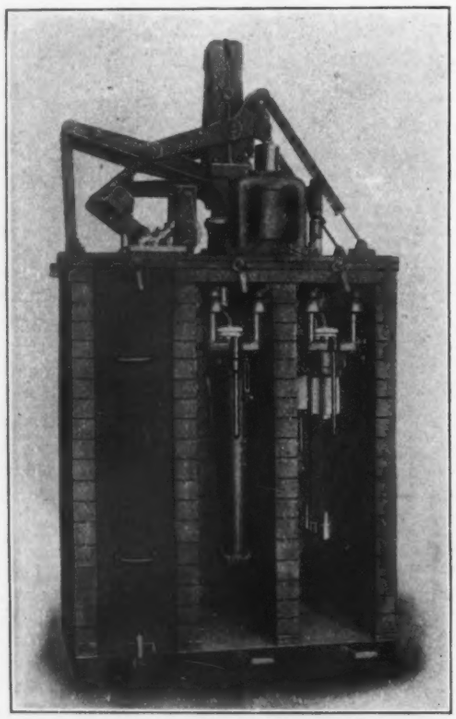


Fig. 1—No-Voltage Release Oil Circuit-Breaker.

Steel Company at Gary, the Westinghouse Company has equipped its standard circuit-breakers with a no-voltage release device which secures the instantaneous opening of the gravity-operated contacts when the control voltage is interrupted.

As shown in the accompanying illustration, one of the toggle-joint members of the standard switch-gear is fitted with an armature which engages and is held by the pole-pieces of the no-voltage coil just before the toggle passes its central posi-

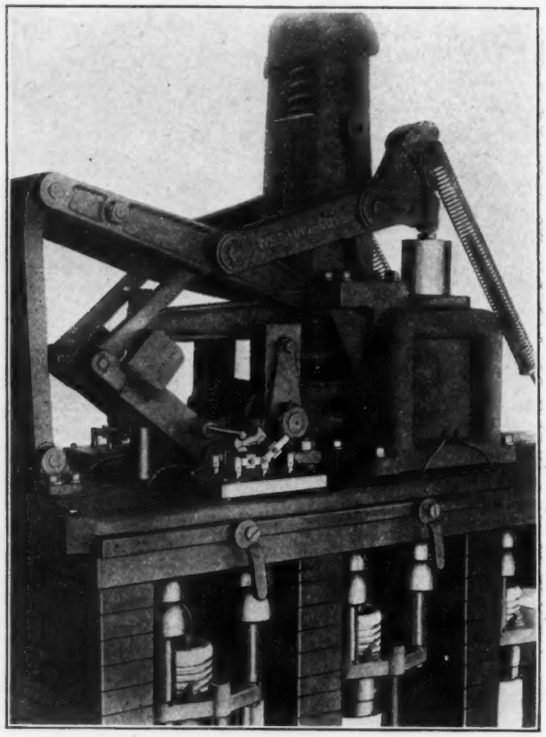


Fig. 2—No-Voltage Release Oil Circuit-Breaker.

tion. In the ordinary breaker furnished without this no-voltage release the contacts are held closed by carrying this toggle over its dead center, where it locks.

In the no-voltage type the toggle is detained by the attraction of the pole-pieces for the armature while still on the operating side of its center, so that in case of any interruption to the control voltage the breaker immediately opens, and cannot be closed except in the usual manner. Full protection is thus afforded to the motors connected through their circuit-breakers, and in the case of overload on the rolls, or failure of the power house, their circuits are immediately opened, so that the machines must be gradually accelerated in the usual way.

Except for the no-voltage release features, these circuit-breakers are similar to the standard oil breakers built by the Westinghouse Company, and include all the features of solenoid operation, oil submersion of contacts, simple lever switch-gear, gravity opening and minimum quantity of oil required, which are among the advantages of the well-known "type C" breakers. The breaker is designed for mounting in a brick or concrete structure, separate cells enclosing the sheet-metal switch tanks of each phase. There are two contacts per pole, an effective barrier between pairs of contacts being interposed by the operating rod and insulating lining of the tank. No high-tension parts or wiring are exposed when the breaker is assembled. A double-throw, double-pole switch operated by the controlling levers serves as a tell-tale, lighting red or green lamps to show the position of the contacts, whether open or closed.

Besides such special services as large motor-starting duty, oil circuit-breakers equipped with no-voltage release are found extremely useful inserted in the service mains of large power customers, where, by opening the circuit promptly, they relieve the heavy load conditions met by the power house in restoring service after an interruption.

PREPAYMENT METER.

New prepayment attachments for use with either direct-current or alternating-current Thomson watt-hour meters have recently been perfected by the General Electric Company. This prepayment device is supplied either in combination with or separate from the meter. Arrangements similar to those shown in the illustrations are made for direct-current meters. The advantage of a separate attachment for some cases will be apparent, for, although it is not always desirable to place the watt-hour meter proper in a location convenient to the consumer, the prepayment attachment can be installed wherever most desirable. The principle of operation is identical in either case, except that the connection between the meter and attachment is mechanical in the case of the combination, and electrical in the other instance. The attachment consists of four principal parts, the escapement train, the coin device, the switch and the rate device.

When it is desired to make an advance payment the winding knob is turned so that the arrow points upward. A quarter dollar is then inserted in the slot and the knob turned to the right, the coin serving as a key which operates the mechanism within the device, turning the registering wheel and placing the coin to the credit of the consumer. If the circuit is open when the coin is deposited, the same motion of the knob which moves the registering mechanism closes the circuit switch contained within the case of the attachment.

The dial of the combined prepayment meter is enlarged and contains in addition to the standard marking, a scale marked in plain figures over which a pointer passes indicating the number of coins remaining to the credit of the depositor. When the meter has a separate prepayment attachment, the dial showing the number of coins standing to the customer's credit is placed on the attachment.

When the first coin is deposited and the knob is turned, closing the main switch, the pointer rests opposite the first division on the scale. If a second coin is deposited before the energy purchased with the first coin has been consumed, a second motion of the knob will bring the pointer opposite the second division on the scale. Twelve coins can thus be deposited consecutively, after which the slot is automatically closed and further prepayment cannot be made until the value of one or more coins has been consumed.

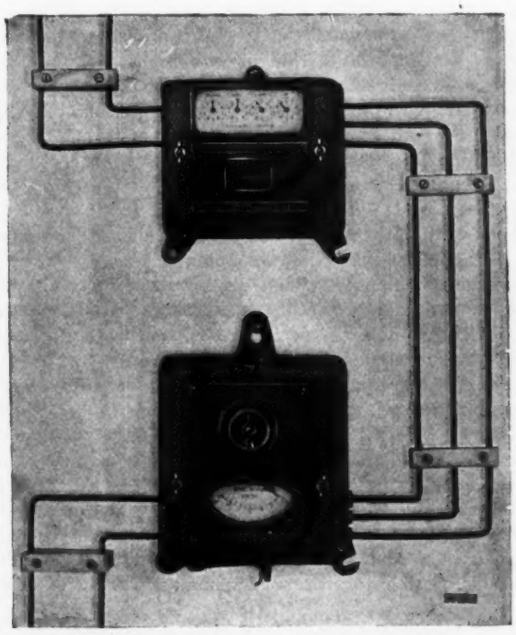


Fig. 1—Prepayment Meter and Watt-Hour Meter.

Whenever energy to the value of one coin has been delivered through the meter, the escapement is released (mechanically in the combined device and electrically in the separate device) turning the pointer back one division. This process continues until all the energy for which prepayment has been made has been delivered. Thus the depositor can ascertain at any time how much energy can be obtained without further prepayment. When all the energy has been delivered the circuit switch is opened and remains open until further prepayment has been made.

Fig. 2—Combination Prepayment Watt-Hour Meter.

The indicating mechanism shows only the number of coins which stand to the credit of the customer, but by consulting the meter dial one can determine what fractional part remains of the prepayment next to be cancelled.

The actuating force which operates the device is a large, flat coil spring enclosed in a barrel or drum to which its outside end is attached. The operating knob winds this main spring by turning the drum. The spring has many turns and as the operation of the device never equals one whole turn, the spring always exerts a practically constant force.

The rate device consists of a small train of gears secured to the front of the frame directly back of the register, the gear ratio depending upon the price charged for the service. Each device is marked with the price per kw-hour for which it should be used. It will be noted that this device is a separate member secured independently to the meter frame so that it can be easily removed and replaced by the electric lighting company in case the rate of charge is changed. The meter can be adapted to any rate of charge from 5 cents to 20 cents per kw-hour in steps of ½ cent.

The switch is of the double-pole, double-break type with leaf contacts, the construction being similar to that used in heavy-current circuit-breakers. The toggle joint used to close the switch arms against the terminal blocks makes it impossible for the switch to open through accidental jar and also prevents any back pressure from being transmitted to the escapement train in such a way as to retard its action. The switch is liberally rated and will, without injury to itself, open any circuit carrying current up to the maximum overload allowable for the largest meter with which the device can be used.

The standard prepayment device is designed for use with quarter dollars. The coin receptacles are placed at the back of the meters so that the covers may be removed without interfering with the receptacle in any way. This feature permits the meter to be tested without affording access to the coin box; moreover, the collector, who is usually unfamiliar with the electrical features of the meter, cannot inadvertently injure its adjustment. The coins fall into a drawer, which is removable from the bottom of the case and which can be secured by either a seal or any suitable padlock. The slot in which the coin is inserted is situated at the top of the meter case near the back.

Every precaution has been taken to guard against fraud. A

coin or washer larger than the coin for which the device is designed cannot be introduced into the receiving slot and a smaller one will not operate the device. The knob, once started with the coin locked in, cannot be reversed, but must be given a half turn to release the coin, which falls through a tube to the money box below. The coin is locked in as soon as the knob is moved and cannot be abstracted except by unlocking the money box. It is only by turning the knob that the consumer can obtain credit for his payment. A coin having a thread or wire attached will operate the mechanism, but the motion of the actuating handle prevents the withdrawal of the coin, which generally passes into the receiving box. Should bits of string prevent the coin from passing to the drawer, the intended fraud will be readily detected.

LARGE SURFACE CONDENSER FOR STEAM TURBINE.

The surface condenser shown in the accompanying illustration is stated to be the largest yet built for land service, if not the largest on record. It is designed to give a 28-in. vacuum when condensing 236,000 lb. of steam per hour, and is to be installed in connection with a Westinghouse double-flow steam turbine. It is one of the "dry tube" type developed by the Wheeler Condenser & Engineering Company, of Carteret, N. J., the essential feature being that shelters or plates are interspersed between the tubes at several different levels in order to catch the condensate and drain it directly to the sump, preventing it from falling upon the lower tubes and thus interfering with the transmission of heat from the steam to the water contained therein.

By means of the dry-tube arrangement, the heat transmission in condensers of the Wheeler "dry tube" type has been raised to 800 or 1000 lb.-Fahrenheit units per square foot per hour per degree difference in temperature, as against 200 or 300 units obtained in older types of condensers. In the present case the steam enters on both sides of the bank of tubes, which gives an exceptionally large exhaust opening and brings the steam immediately into contact with a large extent of tube surface. Keeping the water off the lower tubes also preserves the high temperature of the condensate, thus preserving the heat-absorbing capacity of the circulating water for its proper work of condensing steam, so that less circulating water is

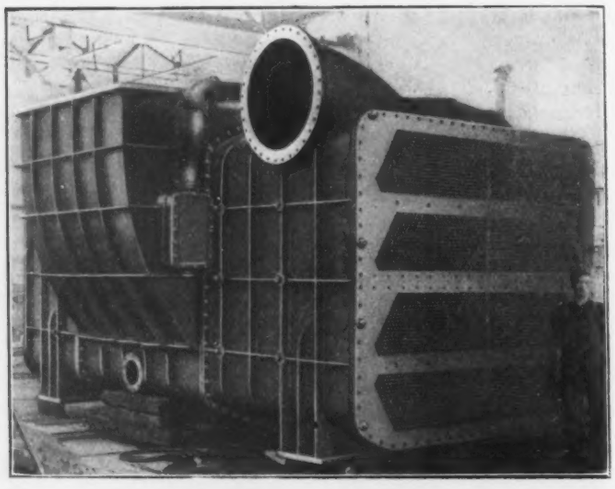


Fig. 1—Surface Condenser.

required, and retaining heat in the condensate, which is a gain from the point of view of the boiler, since a theoretically perfect condenser should deliver condensate of the exact temperature of the steam entering the condenser.

To make certain that this would be the case in the present apparatus, banks of tubes have been placed in the two steam inlet passages on either side of the condenser shell where the steam enters from the two exhaust outlets of the turbine. Water from the sump or hot well of the condenser is forced through these tubes on its way to the secondary heater by turbine-driven centrifugal pumps, making two passes through the tubes on each side. These banks of tubes take the place of a primary feed-water heater, but by placing the heater within the condenser shell, complexity of piping, and possibility of air

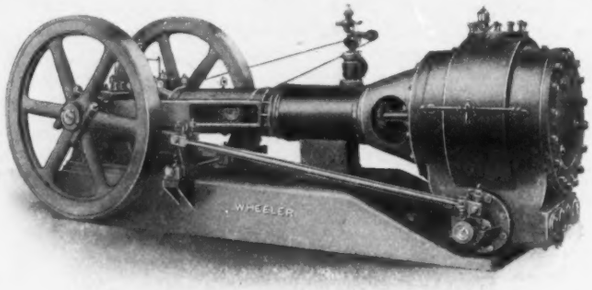


Fig. 2—Air Pump for Condenser.

leaks through added joints are avoided. The interiors of the heater tubes are accessible independently of the tubes of the condenser proper, as will be seen from the photograph.

The air pump for this condenser, shown in Fig. 2, is of the Wheeler straight-line or fork-frame type, with 12-in. steam cylinder, 30-in. air cylinder, and 18-in. stroke. The valves of the air cylinder, which are perhaps the most important part of a dry vacuum pump, are placed at the lower side of the cylinder, and consist of a semi-rotary inlet valve driven by an eccentric on the shaft and poppet outlet valves.

In order to eliminate the capacity-reducing effects of cylinder clearance, the semi-rotary valve is provided with a "shifting" port which places the two ends of the cylinder momentarily in communication just at the beginning of each stroke. That is, after the compressed charge on one side of the piston has escaped through the poppet outlet valves to atmosphere, there will still remain in the clearance spaces a small amount of air and vapor at atmospheric pressure. If this were allowed to remain it would re-expand upon the retreat of the piston, so that the latter would complete some part of its stroke before the pressure would fall to that prevailing in the condenser. This amount of travel would obviously be wasted; that is, no new air or vapor would be taken in.

The action of the by-pass port in the suction valve is to allow this air and vapor at atmospheric pressure to re-expand immediately into the other end of the cylinder, which has lately been the suction end, and is about to become the discharge end, and which contains air and vapor at condenser pressure. As the latter pressure may be but 1 in. of mercury, say, and as the clearance volume is only a very small percentage of the total piston displacement, practically all of the compressed charge in the clearance space passes over to the discharge side, raising the pressure in the latter only slightly. Immediately thereafter, the by-pass port closes, so that the air and vapor which have passed over are compressed and discharged with other contents of the discharge side of the cylinder. At the same time the end of the cylinder which has lately been the compression end and has now become the suction end, contains air and vapors at a pressure only slightly in excess of the condenser pressure and immediately upon the forward movement of the piston begins to take in a fresh charge from the body of the condenser. With this type of air pump it is possible to procure a vacuum within ½ in. of absolute.

As will be seen from the illustration of the condenser, below one of the side entrance openings for the exhaust is an opening for connecting the dry vacuum pump. An important reason for placing the air pump suction at this point is that air is heavier than steam at the same temperature and naturally settles to the bottom of the condenser shell, toward which point it is also driven by the inrush of the entering steam.

EXHIBITS AT PHILADELPHIA ELECTRICAL SHOW.

Herewith are given brief descriptions of the exhibits at the Philadelphia Electrical Show now in progress at the First Regiment Armory, Broad and Callowhill streets. The exhibition is open daily from 10 a. m. to 11 p. m., and will continue until Feb. 26. Although somewhat cramped as regards space owing to the limited size of the exhibition hall, the display is all that could be desired and all the booths are occupied.

Auxiliary Fire Alarm Company, New York, exhibits the Gamewell fire-alarm telegraph system so generally used by cities throughout the country, and also smaller sets applicable for industrial plants and buildings. The latter are of the break-the-glass type and are probably as well known as the standard sets intended for city street use. Messrs. A. L. Bunting and N. MacDougal demonstrate the apparatus.

James Barker, Inc., Philadelphia, has an exhibit of electric vibrators, hair driers and electric barber-shop equipment in charge of Mr. W. P. Gerner. Direct, alternating and universal motors are employed in connection with these devices, and electric heaters are used in combination with small fans in the hair-drying apparatus.

J. C. Bartlett, Philadelphia, shows the Woods electric victoria. These vehicles, which are manufactured by the Woods Motor Vehicle Company, of Chicago, have been described in our columns in connection with automobile shows and are familiar to readers. An effort is being made to increase the number in use in Philadelphia, whose streets are well adapted for vehicles of this type.

J. E. Caldwell & Company, Philadelphia, are making a feature of their electric silver-polishing machines. In a glass case there are displayed silver coffee percolators, silver pocket lamps, silver chafing dishes, silver candelabra and portable lamps. Tiffany Fravill domes and shades of artistic merit are also on view. The following gentlemen are present: Messrs. W. Ennis, F. J. Lynch and R. C. Putnam.

H. B. Camp Company, New York, Pittsburgh and Chicago, has a display of its various forms of clay and vitrified ducts used in underground conduit work. Mr. E. Nickson is in charge of the booth.

City of Philadelphia, Electrical Bureau shows the modern Philadelphia method of transmitting intelligence in connection with the police and fire-alarm systems. The exhibit is set off by four electric flags, as well as by columns and arches. On view are the bureau's types of universal patrol box, positive-recording police-patrol box, combination fire and high-pressure signal-box, fire-signal box, police register for keeping records of patrolmen's calls, dynamotor and motor-generator sets used to replace the old bluestone batteries and methods of handling police business. The exhibit was designed by Chief McLaughlin, of the Philadelphia Electrical Bureau.

Collins Wireless Telephone Company, Newark, N. J., has a working exhibit of its wireless telephone and Collins-Sanchez high-frequency apparatus in charge of Messrs. E. L. Pine, William Debilier and A. F. Collins. A variable tuning transformer, auto-transformer and rotating oscillation arc as well as high-potential apparatus are also in evidence.

Commercial Truck Company of America, Philadelphia, shows a spiral-gear, shaft-drive electric delivery wagon. By the use of the Hindley spiral gear the power is transmitted from the motor to the rear wheels by a single gear reduction, thus giving a simple mechanism. The rear wheels are mounted on ball bearings on the axle housing entirely independent of the driving mechanism and are driven by floating shafts engaging in universal joints in the hub caps, the inner ends of which slip by means of squared ends into the bevel differential gears. The whole mechanism is immersed in oil and the rear-axle unit, consisting of motor, gear casing, axle housing and rear wheels with gearing and driving shafts, is readily removable for inspection and repair. Edison or lead batteries are used with an 85-volt General Electric motor.

Duntley Manufacturing Company, Chicago, has on exhibition a number of its pneumatic cleaners for domestic and commercial use. All of the vacuum cleaners are shown in operation, and those in attendance include Messrs. C. R. Ely, J. A. Hickey, W. M. Wilgus, P. H. Horton and G. R. Eilers.

Diehl Manufacturing Company, Elizabethport, N. J., displays a complete line of its motors, including direct-connected and belted units, fans, individual sewing-machine motors for both alternating-current and direct-current circuits. Electric coffee grinders, buffing machines, ventilating outfits and miscellaneous electrical equipment are tastefully arranged in the booth. Mr. W. Erwin Cheyney is in charge.

Electrical Contractors Association, which includes in its membership almost all of the leading electrical contractors of Philadelphia, has a rather comprehensive exhibit of miscellaneous electrical apparatus and devices, and also shows various methods of wiring houses. The association is in accord with the wishes of the various bodies at present engaged in keeping up the standard of wiring and points with pride to the work of its members. The chief purpose of the exhibit is to interest the general public in things electrical and thus to increase the business of the association.

Electrical World distributes current issues of the paper, as well as current issues of the other publications of the

View of Exhibition Hall.

McGraw Publishing Company. An exhibit of technical books is made by the McGraw-Hill Book Company, and representatives of the editorial and business departments are in attendance.

Electric Storage Battery Company, Philadelphia, exhibits a standard 4000-amp Exide cell, such as is used by the Philadelphia Electric and other Edison illuminating companies, and also samples of the equipment used by the representative vehicle and automobile concerns for motor propulsion and ignition purposes. The detailed parts of the jars, plates, etc., of the battery are on exhibition, as well as a complete "Hyray" lighting outfit for automobiles. A mercury-rectifier charging outfit is shown also. Messrs. E. L. Reynolds and F. Kallis are in attendance.

Engineering Equipment Company, Philadelphia, is making an exhibit of Condit circuit-breakers and Baseler & Hemekin knife switches and panels. Four sizes of air-break circuit-breakers, ranging from 200 amp to 1500 amp, are exhibited, as well as oil circuit-breakers with no-voltage release and overload tripping coils for motor-control work. An automatic oil switch for currents as high as 4500 amp, and one for currents as high as 15,000 amp, are displayed. A feature of the exhibit is a remote-control 1500-amp, three-pole magnetically operated oil switch. Messrs. J. P. Manypenny, G. P. Wilson, Jr., and B. B. Baseler are present.

Federal Electric Company, Chicago and New York, is represented by Messrs. J. J. Magee, H. I. Markham, A. R. Deane, T. Moffitt, N. A. Ross, J. Padmore and W. Hoffman. The exhibit made by this company comprises its sectional letter signs, flasher signs, lamp clusters, "Adlite" window-display system and a line of Federal clamp sockets and bushings.

Fort Wayne Electric Works, Ft. Wayne, Ind., display a line of meters, motors, transformers for bell-ringing circuits, transformers for lighting circuits, a motor-driven house pump, motor-driven washing machine, and "compensarc" and "balancarc" used for moving-picture and stereopticon lamps. Mr. A. H. Boyd is in charge of the exhibit and is assisted by all of the staff of the Philadelphia office of the works.

General Electric Company's exhibit comprises a complete line of mazda and tantalum lamps for 110-volt and 220-volt circuits, heating apparatus, flaming-arc lamps, intensified-arc lamps, motors, rectifiers, etc. Two cabinets lighted by a series of small mazda lamps show miniature lamps of all sorts and sizes. In order to demonstrate the advantage of the mazda over the carbon-filament lamp a photometer with two wattmeters is employed, the latter showing the different power consumptions for equal candle-power. Automobile lighting by mazda lamps is given a prominent place in the exhibit, a model dashboard with head lamps, side lamps and tail lamps being shown. The company's street series mazda lamps are displayed on brackets, and numerous photographs of notable installations of high-efficiency incandescent lamps. Among the representatives of the company present are: Messrs. Mullen, Bailey, Thompson, Gale, Smith, O'Brien, Raymond, Sturgeon and Tattersfield. Mr. L. W. Shugg installed the exhibit.

General Vehicle Company, Long Island City, has mounted to run a 3½-ton commercial truck. The exhibit is in charge of Mr. W. W. White, and in order to demonstrate how easy it is to charge the storage battery from an alternating-current circuit a mercury arc rectifier set is in use, charging the battery with which the vehicle is equipped. The chassis is the standard type used by the company.

Helios Manufacturing Company, Philadelphia, shows its economic lighting system in operation. This system entails the use of a motor-generator, which takes the place of the rheostat usually employed with arc lamps for moving-picture machines. The system is said to effect a saving of 35 per cent to 90 per cent, and ballasts the arc perfectly, as shown by a practical demonstration arranged in connection with a Lubin moving-picture machine. The motor-generator set is mounted on a common base with the switchboard. The Helios battery for vehicle and ignition work, as well as flaming-arc and enclosed-arc lamps are displayed. The alternating-current flame lamp is said to burn 22 hours per trim and operate singly on 110-volt circuits with a power consumption of 335 watts. Messrs. C. P. MacGonigal and G. H. Rettew represent the company.

Hurley Machine Company, Chicago, has on exhibition a Thor electric home-power laundry machine, which is shown in operation washing and wringing clothes.

International Correspondence Schools, Scranton, show the technical books and printed matter regarding their many courses of study, particular reference being made to the electrical engineering courses.

Invincible Renovator Manufacturing Company, Pittsburgh, exhibits through the Invincible Renovator Sales Company its well-known portable vacuum cleaners for domestic and commercial use. In these machines the centrifugal-exhaust principle is employed, so that the intensity is uniformly the same. The power is supplied by a small motor attached directly to the shaft on which the centrifugal exhaust revolves. The machine has already been described in detail in our columns. Messrs. Q. P. Stahlman, D. L. Smeltzer and F. W. Saddler are in attendance.

The H. W. Johns-Manville Company, New York, has a very elaborate display of "Noark" enclosed-fuse devices, fuses, service switches and subway boxes, overhead line material, "Linolite" desk and table lamps, electrical heaters, friction tapes and splicing compounds, molded weatherproof sockets, vulcabeston, Monarch, Phoenix, molded mica and electrobestos insulation, an electrotherm, porcelain insulators, guy anchors, asbestos wood, indurated fiber and detailed supplies for power and railway work. Quite a number of the representatives of the company are in attendance, including Messrs. H. M. Voorhis, D. K. Dickson, R. H. Demott, H. Mullery, H. Snyder, J. W. Day, E. V. Drew, T. Y. S. Nicely, L. R. Yaeger, W. R. Miller, S. R. Fitch and E. Gallagher. The Enos Company, of New York, also exhibits in the Johns-Manville booth opalescent reflectors and electric fixtures. Mr. H. M. Slauson is the Enos representative at the show.

Keller Manufacturing Company, of Philadelphia, demonstrates and exhibits through the Keller-McManus Company its various "Santo" portable vacuum cleaners. In order to show the actual working of the machines, some of them are enclosed in glass. A diaphragm pump driven by a Fort Wayne motor is employed to create the vacuum; two bags collect the dust and friction is reduced by equipping all the shafts with ball bearings. Messrs. H. Keller, C. H. Spotts, C. J. McManus, C. Clifton White and a number of lady demonstrators are in attendance.

Keystone Telephone Company, Philadelphia, has installed a full telephone switchboard equipment, giving service over its entire system, and operates an intercommunicating system between all of the booths in the exhibition hall.

Metropolitan Engineering Company, Brooklyn, N. Y., shows the porcelain cut-outs, enclosed fuses, switches and panel boards manufactured by it. The new line of porcelain material recently developed by Mr. T. H. Murray is prominently displayed in the company's booth.

Edward Miller & Company, Meriden, Conn., make a very attractive exhibit of portable electric lamps and art-glass shades. Messrs. N. A. Dutton, B. H. Dutton and H. L. Dyson are the representatives of the company in attendance.

National Dictograph Company and the **General Acousticon Company,** of New York, exhibit in common. The exhibit comprises an intercommunicating telephone system with sound-magnifying apparatus, enabling a whisper to be distinctly heard, and the acousticon intended for the use of persons partially deaf.

Nernst Lamp Company, Pittsburgh, displays its various types of multiple, single-glower, cluster and fixture lamps. The representatives of the company in attendance are Messrs. Garrett F. Hom, S. Stevenson, J. G. Kanter, E. H. Eyster, H. N. St. Clair, Oliver Mengel, M. H. Huskey and Mr. Pugh.

Nohe Electric Renovating Company, Chicago, demonstrates its electric cleaning outfit consisting of a centrifugal fan, an electric motor to drive it and a dirt chamber, in which the fan deposits dust. The motor is rated at ⅛ hp and may be connected to direct-current or alternating-current circuits. Mr. I. A. Nohe is in charge of the booth.

Otis Elevator Company, New York, shows a working model of an Otis automatic push-button elevator. For this purpose a tower 30 ft. high is employed, divided into three floors. Inside the car is placed the usual bank of buttons. The exhibit is similar to that made by the company at the New York Electrical Show in October, and was described in detail at that time. Messrs. Doan and Miller demonstrate the apparatus.

J. C. Parker & Sons Company, Philadelphia, exhibits a Detroit electric roadster, built by the Anderson Carriage Company, of Detroit, Mich. The vehicle is equipped with either lead or Edison-type batteries and has been described in these columns several times.

The Philadelphia Electric Company's exhibit occupies the center section of the armory, and in it the company shows a section of manhole to illustrate its underground distribution system; a pole line and transformer to illustrate its overhead distribution; a complete service connection with meters, etc., so as to give its patrons some idea of the methods used in transmitting the electricity from its generating station to them. The working of meters is demonstrated and explained in detail by a staff

from the company's office in another section of the booth. The relative color properties of the various types of lamps on the market are shown in connection with vari-colored goods in adjacent compartments, and in the center of the space is a large revolving stand containing interesting pictures of the company's generating system, substations and various examples of motor-driven refrigerating machinery, motor-driven industrial plants, church, store and private-house illumination, etc.

Philadelphia Rapid Transit Company makes a very interesting exhibit, showing the operation of its elevated railways through the medium of a miniature elevated-railroad structure, and also shows a full-size semaphore signal. An emergency wagon recently built for the company is one of the features of its exhibit, and sections of various size cables used in feeding its vast network of railways are appropriately mounted on a panel.

H. T. Paiste Company, Philadelphia, manufacturer of electric light specialties, has a rather elaborate display in one corner of the exhibition hall. The company's pipe taplets for rigid conduit work, outlet boxes, sectional panel boxes, molding taplets, iron boxes and various specialties are exhibited. By means of 21 fittings and standard goods it is claimed that 1890 different wiring devices can be made. The company manufactures about 650 different electric light specialties, all of which are quite well known to the trade. Those in attendance included Messrs. W. W. Winship, W. T. Thomas, E. A. Jenkins and G. MacElwee.

Portable Battery Fan Company, Philadelphia, shows a small fan motor operated by a portable storage battery enclosed in a jar on which the motor rests. The 9-in. fan is operated from a single cell giving 2 volts and is said to have a storage capacity of 200 amp-hours. The complete outfit weighs 25 lb. and is guaranteed to run for 50 hours. The 12-in. fan operates from a 6-volt battery and weighs complete about 40 lb. The smaller battery is made up of two pasted lead plates, rather thick and with the positive resting on the bottom of the jar in a horizontal position. The negative plate is also arranged horizontally. Mr. H. H. Hirsch is in charge of the exhibit.

Philadelphia Electrical & Manufacturing Company, Philadelphia, has on view and fastened to an ornamental pole a number of tungsten arc lamps. The street fixtures are equipped with 60-watt lamps and may be fitted with large radial wave reflectors or globes, the fixtures being interchangeable. The lamp resembles the ordinary arc lamp in appearance and the fixture fitted with a 400-cp tungsten lamp gives a better quality of light and at less expenditure of energy than the average enclosed arc lamp. A number of the fixtures are fitted with 250-watt lamps. The lamp has found a wide application in displacing gas lamps and is adapted for interior, exterior, show window and street lighting. Messrs. William Dale and C. L. Bundy represent the company.

Robbins & Myers Company, Springfield, Ohio, makes a complete display of all types of electric fans and small motors manufactured by it. An organ blower outfit driven by a ½-hp Standard motor is on exhibition and a feature is made of the company's universal bracket and oscillating fan. The fan is self starting in all positions as well as convertible from desk to bracket type without the use of tools or any extra attachment. The oscillating movement begins automatically whenever the fan is started, regardless of the position in which the fan is stopped and reverses at any speed. The swinging portion of the fan is balanced within its yoke, making the oscillating movement independent of the angle at which the fan may be inclined. By means of a worm-wheel operated with a thumb piece the fan can be adjusted by hand to any angle desired, when the fan is being used in either the desk or bracket type without in any way interfering with the oscillating movements. The movement is very smooth and free from jar; the mechanism is simple, and the motor operates from either direct or alternating-current circuits. The line of direct-current motors built by the company ranges in size from 1/20 hp to 15 hp. Messrs. E. B. Day and G. H. Pechin are present in the interests of the company.

The Sanitaria Company, Philadelphia, displays the Shelton vibrators and hair driers and an actino-therapeutic lamp. In another section of the armory an X-ray apparatus for curing tuberculosis is shown in operation. The latter comprises a chair with high-frequency tubes grounded, an X-ray tube before which the patient sits and an ozonizer from which the patient inhales ozonated oils. It is claimed that owing to the presence of the high-frequency coils, the patient may be subjected to the rays for a long while without danger of burning. Dr. Howells is in charge of the demonstration work.

Simplex Electric Heating Company, Cambridge, Mass., makes a very complete exhibit of electric heating devices. Indeed, it would be difficult to imagine a heating device not shown in its booth. There are toasters, nursery milk warmers, irons of all types, stoves, chafing dishes, water cups, curling-iron heaters, heating pads, percolators, dining-room outfits, waffle irons and an array of commercial heating devices. Mr. E. B. Stebbins is in charge of the exhibit and he is assisted by Messrs. L. Warfield and Roger Williams.

Studebaker Brothers' Philadelphia office has placed on exhibition an electric victoria and a coupe. The vehicles are familiar to all users of electric pleasure cars and have been described in our columns. Mr. G. D. Woodworth is present.

B. F. Sturtevant Company, Hyde Park, Mass., shows a 30-in. propeller fan, portable ventilating sets, a dust blowing fan and vacuum cleaners. The latter machine is composed of a small aluminum fan and case connected to a dust separator. The fan is driven by a direct-connected motor built to operate on either direct or alternating-current circuits. The dust collector consists of a series of baffle plates and screens. The usual equipment of tools forms part of the outfit. Mr. A. C. Warfel represents the company.

United Wireless Telegraph Company has a complete commercial wireless telegraph station in operation at the show.

Vacuum Engineering Company, New York, shows two rotrex vacuum cleaning plants, one showing a direct-connected motor and the other a silent chain motor-driven outfit. Both are stationary and are intended for installation in the basement of buildings with pipe lines running to such points as are most convenient for hose connections. The pumps have no sliding blades, wearing strips or valves and the plant has no separating tanks, the dirt being taken into a separating chamber where it is dissolved and then carried automatically and directly to the sewer in the shape of dirty water. Messrs. William Trump and J. S. Tyrell are in attendance.

Walker Electric Company, Philadelphia, exhibits a sample generator and motor panel together with I. T. E. circuit-breakers and apparatus manufactured by The Cutter Company. A panel box with adjustable corner braces, voltmeter and ammeter switches, knife switches, etc., are on display. A feature of the exhibit is a motor-operated circuit-breaker for heavy circuits; the circuit-breaker being reset by the motor which can be controlled from a distance. Mr. Philip H. Ward, Jr., is in charge of the booth.

Westinghouse Electric & Manufacturing Company's exhibit includes alternating-current rectifiers, motors, motor applications, incandescent lamps, commercial and domestic heating appliances, arc lamps, etc. Mr. W. Barnes, Jr., of the publicity bureau, is in charge of the exhibit.

Western Electric Company displays a line of Hawthorn alternating and direct-current motors, intercommunicating telephone sets, arc lamps, testing sets, flaming-arc lamps and miscellaneous electrical house goods. The trade mark of the company, "Hawthorn," is outlined by 800 incandescent lamps and set in the background of the booth. Those in attendance include Messrs. Frank Killion, A. L. Hallstrom, F. C. Jaeger and G. Livzy.

Williamson Motor Company, Philadelphia, is exhibiting products of the Whitney Instrument Company, Swing Electric Company, S. E. Circuit Breaker Company, Bell Electric Motor Company and the Hartman Circuit Breaker Company, together with sheet-iron boxes manufactured by itself. Messrs. H. Clayton and W. Baylie are in attendance.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

There is the same evidence of hesitation in commercial business apparent in the reports for last week that were noted in the reports for the previous week. Taken as a whole, the record of the week is marked by an exhibition of uncertainty and the development of quite a considerable sentiment of conservatism. Whether or not this is only the reflection of the general stagnation and depression that has attacked the security market, or is due to a widespread feeling of alarm that has taken possession of the country, remains to be seen. It certainly is a fact that in every section, except perhaps the Northwest, there has been a marked falling off in the buying at retail stores, and consequently a contraction in the orders from retailers to jobbers. The conservatism is especially noticeable in the dry goods and shoe trades. While large numbers of buyers are visiting the central distributing points, it is noticeable that the purchases being made are almost universally below what had been anticipated by the wholesalers. The lesson of the recent panic, or period of depression, or whatever you choose to call it—it makes no difference about the name—seems to have been a lesson in conservatism. The retail merchant is extremely wary and is timid about over-stocking; he prefers to run short of goods rather than to run the risk of having to pay for wares he cannot sell. As a rule, however, the industrial plants of the country are busy, and so far there have been no reports of recessions in orders. The general report concerning collections is that they are distinctly slow and renewals are frequently asked. Business failures for the week ended February 10, as reported by *Bradstreet's*, were 249, as against 232 for the previous week, 211 for the same week in 1909, 325 in 1908, 204 in 1907, and 208 in 1906.

THE COPPER MARKET.

Although there has been quite a marked improvement in the tone of the copper market, due to the gratifying statement made by the Copper Producers' Association for the month of January, there has been very little increase in the actual purchases of metal. The effect of the statement was very much more conspicuous in its effect upon copper shares in the stock market than it was upon the actual copper market. In other words, its benefits were more promisory than immediate. The same rate of decline in surplus stock, that was shown in January, if continued for several months would entirely wipe out the depressing accumulation. There is, of course, little reason to calculate that this decline will continue to be so great, and it must never be forgotten that the visible supply in Europe continues to increase. The domestic deliveries for the month and the exports were surprisingly high, when it is considered that sales during the month have been exceptionally light. The deliveries of sales made last fall have brought up the totals to the best within a twelvemonth. The figures in pounds for January given out by the association were as follows, with comparisons with December and January, 1909:

	Jan., '10.	Dec., '09.	Jan., '09.
Stocks	141,766,111	153,003,527	122,357,266
Production	116,547,287	117,828,655	112,135,200
Total	258,313,398	270,831,182	234,492,466
Domestic deliveries	78,158,387	69,519,501	51,862,624
Exports	81,691,672	59,546,570	38,499,797
Total deliveries	159,850,059	129,066,071	90,362,421
Surplus stock	98,463,339	141,766,111	144,130,045
Decrease for month	43,302,772	11,237,416	.....

Prices during the week not only failed to advance, but there were evidences of concessions being made by sellers in both electrolytic and lake. These concessions, however, stimulated little buying. The consumers appear to be fairly well stocked, and owing to the temporary pause in business activity seem to be unwilling to carry larger quantities. Neither consumers nor speculators abroad are actively in the market. Imports continue to be heavy and exports are fair. The latter for the month, including Feb. 14, have been 16,015 tons. The figures in the table quote standard copper at the daily call on the Metal Exchange, Feb. 14:

	Bid.	Asked.	Settling price.
Spot	13.00	13.15	....
February	13.00	13.15	13.07½
March	13.00	13.12½	13.07½

Market weak.

The London prices Feb. 14 were as follows:

	Noon.	Close.
Standard copper, spot	£59 10 0	£59 1 3
Standard copper, futures	60 7 6	59 17 6
Market	Steady	Weak
Sales of spot		1,000 tons
Sales of futures		1,200 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	13.50	13.10
London, spot	£62 0 0	£58 17 6
London, futures	62 18 9	59 15 0
London, best selected	65 10 0	63 0 0

Dodge & Day Contracts.—Among recent contracts awarded to Dodge & Day, Philadelphia, are the following: plans and construction supervision of Kent building; concrete 11-story manufacturing building in Williamsburg, New York City. Plans for a large factory for the United States Light & Heating Company, at Niagara Falls, for the manufacture of car-lighting equipment, including storage batteries. Plans for a large addition to the automobile plant of the H. H. Franklin Mfg. Co. at Syracuse, N. Y. The same firm has just completed a commission aggregating an expenditure of $400,000 for new buildings and operating improvements for Warner Bros., Bridgeport, Conn., and another for the Penn Chemical Works of Philadelphia. In the latter case Dodge & Day acted first as industrial engineers, then as architects and finally as contractors.

The Company Employee Gift Abuse.—The Boston Edison Company has prohibited the circulation of subscription papers, except under special circumstances, having for a purpose raising money for making a gift to officers or subordinates. The order states that it appears that when one of the company dies or gets married, or does anything particularly unusual, a subscription paper is apt to be circulated. While the object may be a good one, and probably 90 per cent or more of the men who subscribe like to do so, there is also the danger that some persons may be asked to subscribe to things which they do not really care about, but are afraid to refuse for fear of appearing niggardly or unfriendly. For occasions where a subscription would seem proper a method of procedure is laid down.

Flaming Arc Lamps in Demand.—The flaming arc lamp seems to be growing in popularity with merchants' associations and similar bodies that are developing plans for making brilliant the business sections of some of the smaller cities. The Excello Arc Lamp Company, which has recently closed a contract for the business center of Newark, N. J., reports that many inquiries have been received from other places and that it is likely a number of similar installations will be made. Merchants all over the country seem to be watching the Newark experiment. In this case the Public Service Corporation pays for the installation under contract with the city, and the merchants pay the city and for the current used.

Canadian General Electric Expansion.—According to Frederic Nicholls, 2d, vice-president and general manager of the Canadian General Electric Company, the company is planning to erect new buildings and equipment to the extent of between $250,000 and $750,000. Nothing definite has been decided upon, however, as to whether the extensions will be built in Toronto or Peterboro.

Ideal Electric Company.—The Ideal Electric Company, Los Angeles, Cal., has been formed to carry on a general electrical constructing and engineering business and to act as Pacific Coast Agents for manufacturers of electrical and mechanical specialties. The offices and salesroom are located at 208 E. 9th St., Los Angeles, California. The new firm requests catalog and advertising matter for its files from manufacturers and dealers.

Washington Water-Power Company.—For some weeks there has been a persistent rumor that James J. Hill, of the Great Northern Railway, or interests identified with him, had secured control of the Washington Water Power Company of Spokane. This rumor has been denied emphatically not only by the officers of the company but by Mr. Hill. The latter said last week, with great positiveness, that he had not bought, had no intention of buying and did not want the property. At a meeting of the directors of the company, Feb. 11, new officers were elected as follows: President and general manager, David L. Huntington; first vice-president and chairman of executive committee, Henry M. Richards; second vice-president, H. L. Bleecker; assistant general manager, C. S. MacCalla; treasurer, H. C. Perks; assistant treasurer, J. C. Douglass, and secretary, H. C. Begran. Mr. Huntington, the general manager, announces that the plant at Little Falls on the Spokane River 34 miles below Spokane, will be ready for operation early in June. The work on the plant, which will develop more than 30,000 hp, has been in progress 22 months. The turbines, of which there are four, are designed to develop upward of 9000 hp if put to fullest capacity. "We now have 100 miles of street railway and 430 miles of high-tension transmission line running into neighboring cities, and as far away as the Cœur d'Alene mining district," said Mr. Huntington. "Our load is increasing all the time and we will need all the additional power we can develop. Our aim is to keep building just fast enough so as to have a safe margin at all times. With a total length of more than 900 feet, in the neighborhood of 50,000 cubic yards of concrete are required in the construction of the dam and the buildings. With the exception of an opening for the passage of teams the core wall of the dam is practically complete. The generating room is 155 by 71 feet, the transformer and switchboard room being 161 by 70 feet, the height above water level is 80 feet. There is a fall of 68 feet in the stream. The transmission line from the new station will be 28½ miles in length and will connect with the present lines at the Twenty-ninth Avenue sub-station. At present one of the largest power stations in the Northwest is located at Post Falls, Idaho, 24 miles above Spokane, on the Spokane River. It is owned by the Washington Water Power Company and develops 18,000 hp. The company's station at the falls in Spokane is capable of developing 12,000 hp."

Public Service Corporation Equipment.—The Public Service Corporation of New Jersey has just made contracts with the Westinghouse Electric & Manufacturing Company and the General Electric Company for more than $500,000 worth of machinery for its power houses and sub-stations. The new equipment will be apportioned to the various divisions of the company's system so that improvements will be made in all of them. The contracts will call for generating apparatus of a capacity of 15,000 kw, and as the old machines to be displaced have a capacity of only 2000 kw, the gain of about 13,000 kw will be additional capacity available for lighting and railway business. In the list of apparatus bought is one 9000-kw turbo generator, to go to the Marion power station, and three 2000-kw turbines, two of which will be put in service in Paterson and one in Cranford. The 9000-kw. turbine and two of the 2000-kw. turbines were bought from the General Electric Company, the other 2000-kw turbine will be made by the Westinghouse company. A new rotary transformer of 2000 kw capacity will be set up in the Garfield avenue sub-station, Jersey City; a similar rotary has been bought for the service in Newark; one of 1500 kw will go to West New York to improve conditions in the North Hudson section, and a 500-kw rotary will go to Plainfield. In addition to the foregoing the company has ordered fourteen 500-kw, three 1000-kw and two 250-kw step-down transformers, together with a full complement of switchboards, etc. Of the apparatus bought, practically every station and sub-station will get something. One effect of the changes will be the closing of the old Wayne street station in Jersey City.

Maumee Rapids Electric Company.—The organization of the Maumee Rapids Electric Company, of Toledo, Ohio, will give that city, it is said, a competitor of the Toledo Railway & Light Company in the lighting and power business, if the plans are carried to completion. The company is capitalized at $350,000, and the incorporators are George W. Stevens, Charles S. Ashley, Grant Miller, Hugh W. Haslup and Eliot Norton. The charter gives the company the right to supply heat and energy for light and power in Lucas, Wood, Fulton, Henry, Williams, Defiance, Paulding and Putnam counties. Financial backing is being furnished by Eastern interests it is said. An old power plant has been purchased at Miami, and new hydro-electric machinery will be installed. Contractor J. C. Carland has been at work on the plant, and it has been fitted with new gates and other improvements. This plant will develop about 3000-hp, but the plans also contemplate plants near Providence and Grand Rapids, which will increase this to 10,000 hp. The company has secured the right from the State to build a transmission line on the canal bank, but no arrangements have yet been made for the distribution of energy in the city.

Western Electric Company's Business.—Returns for the first two months of the Western Electric Company's fiscal year, which began Dec. 1, 1909, showed a ratio of business which it is estimated will bring to the company approximately $61,000,000 of gross earnings for the current fiscal year. If this is true, the present year will rank as the second best in the company's history, being exceeded only by the gross earnings in 1906, which were $69,000,000. The January sales were not only larger than December, but show an increase of 46 per cent over January, 1909. Special improvement in the demand for telephone apparatus and lead-covered cable was the feature of this increased business. It is said that the sales of machinery and electric light apparatus are also very satisfactory. The company is actively pushing its business on the Pacific Coast. The directors have authorized an expenditure of $500,000 for the extension of the Hawthorn plants. It is said that the Western Electric Company carries its plant on its books at about 50 per cent of the original valuation.

Legislation to Aid Baltimore.—The next legislation which Baltimore will ask relieving it from the monopoly of the Consolidated Gas, Electric Iight & Power Company will be decided upon during the latter part of this week at a conference between Mayor Mahool and City Solicitor Poe. Mr. Poe says the city will not present for repeal the section of the charter of the Susquehanna Power Company, which excludes that company from selling electricity in Baltimore, although the city officers would support an effort to have it repealed. The actual presentation, Mr. Poe said, would have to be made by the company. Mayor Mahool will either demand the repeal of all legislation restricting the distribution of gas and electricity, or obtain a general act giving the city the right to grant a franchise to any company it sees fit.

Oppose 3-Cent Bridge Line.—There was a conference last week between the leading traction lines of New York and Brooklyn, at which it was determined to take concerted action to oppose the granting of a franchise to the Manhattan Bridge Three-Cent Line. The Brooklyn Rapid Transit Company, Coney Island & Brooklyn and the Metropolitan Street Railway were all represented at the meeting. The opposition was made before the Public Service Commission and also the Board of Estimate. The Brooklyn companies offered to carry passengers across the new bridge for 3 cents, but this offer contemplated only to a terminal at the Manhattan end of the bridge.

Testing Edison Storage Battery Cars.—Joseph B. Mayer, receiver for the Twenty-eighth and Twenty-ninth Street cross-town lines in New York proposes to give a thorough and practical test of the Edison electric storage battery car. The test will last two weeks, and if found practical the receiver will order nineteen cars and eliminate the horsecar system entirely. The line has been operated for the past few years simply for the purpose of holding a franchise. The bondholders committee has not yet decided as to how the new cars, if they are ordered, will be paid for, but it will probably be by the issuance of receiver's certificates.

Madison Light Company Asks a Franchise in Chicago.—The Madison Light Company of Chicago has requested the City Council to grant it a franchise to "lay, construct, maintain and operate wires, pipes, conduits and other conductors for the transmission and distribution of electricity and steam" in a territory bounded by Randolph, Madison, Dearborn and Clinton Streets. The company expects to erect a plant in the basement of the new building to be erected at the corner of Market and Madison Streets by William R. Hearst.

Edison Batteries for Detroit Electrics.—It has been announced by W. C. Anderson, president of the Anderson Carriage Company, which manufactures the Detroit Electric Vehicles, that a contract has been made with Mr. Edison for the use of the new battery for use on Detroit Electrics.

Another Power Development at Spokane.—Spokane Railway & Power Company, capitalized at $2,000,000, has filed articles of incorporation to build a plant to develop between 30,000 and 35,000 hp in the Spokane River, 30 miles below Spokane. The plant will cost $1,500,000, and is to be in operation within two years. The incorporators are D. M. Drumheller and Alfred Coolidge, of the Traders' National Bank, and H. L. Moody, a local capitalist, the latter being president of the company. Mr. Moody gave out this statement: "We will enter the Spokane market as distributors of electric light. This does not mean that we are in opposition to the Washington Water Power Company, but we recognize Spokane as an open market and we will develop our power for the purpose of sale and distribution in Spokane. We will be able to sell power delivered in Spokane at $14 a horse power. We will build a dam at a point on the Spokane River near the LePray bridge, which is a famous old landmark in this country. The site has already been acquired and we have already secured most of our riparian rights."

New Haven Railroad After Water Powers.—Timothy S. Byrnes, vice-president of the New York, New Haven & Hartford Railroad Company, declared before the Railroad Committee of the Massachusetts Legislature last week that his company was prepared to spend within the next 10 years $50,000,000 in the development of transportation facilities in Massachusetts, and that he believed that within 15 years the company would furnish light and control all of the water-power rights in every city on its lines. This is the first announcement that the railroad company is seeking to acquire water-power rights. Mr. Byrnes also said that Mr. Mellen, president of the company, wanted to make the development of the road a monument to himself, and that he was prepared to spend $25,000,000 at once in improvements in the immediate vicinity of Boston. This would include a tunnel connecting the North and South stations. Mr. Byrnes estimated the cost of the electrification of the New Haven and Boston & Maine lines at between $25,000,000 and $40,000,000.

Kennebec Development Company.—The Kennebec Development Company, of Skowhegan, Maine, has prepared plans for the development of the water power of the Kennebec River. It is proposed to construct three large dams at Indian Pond, a short distance below Moosehead Lake's outlet, where the two outlets come together. The cost of this construction, it is estimated, will be about $9,000,000, and it is expected to develop 90,000 hp. The work will be commenced in the spring, as soon as the weather permits. The energy generated will be transmitted throughout the State, and it is said that 30,000 hp has been contracted for already.

Demand for Insulated Wire.—Manufacturers of insulated wire report that just at the present time the demand for insulated wire has slackened to some extent, but that there is every reason to believe that when building operations begin in the Spring orders will be plentiful. The disturbance to the trade that was occasioned last Fall by price cutting on the part of some small manufacturers is said to have about disappeared, and while it is stated that there is no association or trade agreement to govern, it is expected that better prices will prevail during the coming year.

Southern California Edison Company.—It is announced that the Southern California Edison Company, of Los Angeles, is preparing plans for the construction of another power plant in the Santa Ana Canyon, which will involve an expenditure of about $600,000. The plant will be located in what is known as Lost Man's Canyon, and will have an output of 7000 kw. This will make the sixth plant this company has developed in the Santa Ana Canyon above Redlands. The total output of the six will amount to 16,000 kw.

New South Carolina Traction.—The Spartansburg & Greenville Railroad Company has been chartered in South Carolina to construct an interurban line 31 miles long between the two cities named in the title. The officers of the new company, which has a capital stock of $100,000, are Charles W. Ellis, president; H. H. Price, vice-president, and C. H. Yates, secretary. This line will be a competitor of the project recently started—the Greenville, Spartansburg & Anderson Electric Railway—by interests identified with the Southern Power Company.

General Electric Company's Extension.—The General Electric Company has let a contract for the construction of a foundry on the plot of 900 acres which it recently acquired at Erie, Pa. The company frequently has difficulty in securing steel castings as rapidly as they are needed, and for some time has been planning to increase its foundry equipment. The report, published in the West, that it had been arranged to build four factories at Erie, and to employ 8000 workingmen there, is pronounced by officials of the company to be erroneous.

Coos Bay Gas & Electric Property Sold.—Seymour H. Bell, of Portland, Ore., has sold the property of the Coos Bay Gas & Electric Company, Marshfield, Ore., to the H. M. Bylesby Company, owners of the Tacoma, Wash. The company supplies both gas and electric energy to the cities of Marshfield and North Bend. About $400,000 is said to have been involved in the deal.

Davenport (Iowa) Water Power Company.—The Davenport Water Power Company will soon commence work upon the construction of its proposed hydroelectric plant. The company intends to utilize the water power of the Davenport-LeClaire Rapids in the Mississippi River.

Financial Intelligence.

THE WEEK IN WALL STREET.

After having touched, on Feb. 8, the low points of the past six months, stocks began a recovery last week that has gradually continued up to the present writing. The sentiment of traders is considerably monoptimistic and the entire tone of the market is further from demoralization. That feeling of nervousness and uncertainty which was so conspicuously in evidence during the previous week seems to have practically disappeared. There is no longer a condition of semi-panic over possible decisions of the Supreme Court, over dread of drastic anti-corporation legislation, or the activities of administrative prosecutors. In addition, there was developed last week quite a distinct market support from important financial interests. Banking interests which had almost entirely withheld support to the market during its decline or at best had extended aid grudgingly, came to the front liberally with assistance to those who were ready to buy. In addition, there were a number of purchases made by insurance companies, chartered outside of New York, and by trust companies. Small investors, too, from all parts of the country seem to have arrived suddenly at the conclusion that the recession in prices was temporary and that it was a good time to pick up bargains. Buying orders from these were numerous during the latter part of the week, and the advantage to the market of such buying is obvious. Shares thus accumulated are not as a rule carried in bank, will not be offered soon for sale and tend to reduce the amount of floating stock in the market. Taken altogether, the situation is vastly improved. The money market continues to be easy. Quotations Feb. 14 were: Call, 2¾ at 3 per cent; 90 days, 3¾ per cent. The quotations in the table are those of the close, Feb. 14.

NEW YORK.

	Feb. 7.	Feb. 14.	Shares sold.		Feb. 7.	Feb. 14.	Shares sold.
All.-Ch	11½	12	700	Int.-Met., pfd.	45½	52⅝	31,350
All.-Ch., pfd.	37½	41*	1,600	Mackay Cos.	86¾	90	300
Amal. Cop.	72¼	76⅜	306,375	Mackay C., p.	76⅛	76	215
Am. D. T.	20½*	20½*	———	Man. Elev.	135	137*	794
Am. Loc.	47⅜	49½	9,650	Met. St. Ry.	18	17*	300
Am. Loc., pfd.	110	113	400	N.Y.&N.J.Tel.	139¼*	139¼*	———
Am. Tel. & C.	77	77*	———	Steel, com.	75½	80	1,205,512
Am. T. & T.	135¼	137¼	10,900	Steel, pfd.	118	119½	31,254
B. R. T.	69½	73⅛	27,325	W. U. T.	69¼	72	2,400
Gen. Elec.	147½	152¾	4,450	West'h., com.	63½	67	7,600
Int.-Met.,com.	18¼	20⅝	30,750	West'h., pfd.	121	121*	100

PHILADELPHIA.

	Feb. 7.	Feb. 14.		Feb. 7.	Feb. 14.
Am. Rys.	45⅞	46¼	Phila. Elec.	14⅛	14¾
Elec. Co. of A.	12⅛	11⅞	Phila. R. T.	25¾	26⅝
Elec. St. B'ty	56½	58½	Phila. Trac.	88½*	89
E. S. B'ty, pfd.	30*	30*	Union Trac.	50⅜	51⅜

CHICAGO.

	Feb. 7.	Feb. 14.		Feb. 7.	Feb. 14.
Chi. City Ry.	180*	180*	Chi. Tel. Co.	128	128
Chi. Rs., Ser. 1.	107½*	107½*	Met. El., com.	17*	17*
Chi. Rs., Ser. 2.	29	29¾*	Met. El., pfd.	51	53*
Com. Edison	115	115	Nat'l Carbon.	106½	105*
Chi. Subways	3½*	3¾*	Nat'l Car., pfd.	116¼	116½

BOSTON.

	Feb. 7.	Feb. 14.		Feb. 7.	Feb. 14.
Am. T. & T.	135⅛	137¼	Mex. Tel.	3½	3½
Cum. Tel.	147*	147*	Mex. Tel., pfd.	6	5½
Edison E. Ill.	245	245¾	N. E. Tel.	135½	136
Gen. Elec.	151	150	W. T. & T.	15*	15
Mass. E. Ry.	16	18⅛	W. T. & T., pfd.	91*	90*
Mass. E. R., pfd.	80	84½			

* Last price quoted.
Shares sold are for week of Feb. 7 to Feb. 11.

Denver Gas & Electric Light Company.—An explanation of the relations of the Denver Gas & Electric Light Company with the Lacombe Electric Company was made last week by a member of the firm of H. L. Doherty & Company, which controls and operates the Denver company. The fact that certain bondholders of the Lacombe company had brought suit and were organizing to get possession of the Lacombe property has already been referred to in these columns. "The truth about this whole matter is," said this gentleman, "that the holders of some of the bonds of the Lacombe company want us to pay them 104 for their bonds. This we will not do unless it is at the end of a lawsuit. The Denver company bought, several years ago, all the stock of the Lacombe company and then made a contract with that company whereby its plant was leased at a fair rental. This rental has been more than enough to pay the interest on the $900,000 bonds of the Lacombe company and to provide a suitable sinking fund for their retirement. The Denver company never obligated itself to take up the bonds of the Lacombe company, and they are still a first mortgage on the property of that company and have all the security behind them that they ever had. When the Denver company made its new bond issue last year, however, it set apart $900,000, of bonds, to be used in taking up these Lacombe bonds. It has offered and is offering now to exchange these new bonds for the old. In other words, we are willing to buy the bonds if ours will be accepted in payment. There was a clause in the original mortgage of the Lacombe company which permitted the stockholders to call in the bonds at 104, and this is what the bondholders demand. The present stockholders will never vote affirmatively on that proposition."

Chicago Telephone Company's Report.—The annual report of the Chicago Telephone Company for the year ended Dec. 31, 1909, shows net revenues of $2,220,708, which is equal to 8.22 per cent on the $27,000,000 of capital stock. This compares with 7.68 per cent earned in the previous year. Speaking of the business of the year, President Bernard E. Sunny says: "The volume of business shows an improvement of almost 15 per cent over 1908, owing to the improved general business conditions. The net increase in the number of telephone stations for the year was 31,179. Ten years ago, after the company had been in operation for 20 years, it had in operation 27,773 telephone stations, showing that the increase last year was greater than the tital number of stations 10 years ago. Preparations are being made for the erection of a new exchange in Federal Street near Van Buren. The building will be seven stories high for the present, but will be so constructed that nine additional stories can be added." At the close of 1909, 262,359 telephones were in service. These instruments were operated by means of 493,787 miles of underground wires, 69,666 miles in aerial cables, and 62,985 miles of wire in poles, a total of 626,438 miles of conductors. This represents a mileage increase of 13.8 per cent over 1908, the largest component item of which is the 16.7 per cent increase in underground-cable work. The Chicago Telephone Company employs 8104 persons, drawing yearly wages and salaries amounting to $5,100,000. The officers of the company are: President, Bernard E. Sunny; vice-presidents, Byron L. Smith and Angus S. Hibbard; secretary and treasurer, Charles E. Moseley; auditor, Benjamin S. Garvey.

Report of Metropolitan West Side Elevated Railway Company of Chicago.—During the year 1909 the traffic of the Metropolitan West Side Elevated Railway Company of Chicago showed a slight increase, the daily average for the year being 143,889 as compared with 140,950 for 1908. In 1907, however, the daily average number of passengers carried was 148,715. The financial report to the stockholders at the annual meeting on Feb. 7 showed gross earnings of $2,818,430, compared with $2,746,840 in 1908. The net earnings were respectively $1,400,354 and $1,336,039. The proportion of operating expenses to gross earnings decreased slightly, being 51.36 per cent in 1908 and 50.31 per cent in 1909. The fixed charges for 1909 amounted to $1,062,596 and the amount available for dividends was $348,917. This is equal to a trifle over 4 per cent on the outstanding preferred stock.

United Gas Improvement Company Stock.—At a special meeting of the stockholders of the United Gas Improvement Company, of Philadelphia, last week, the capitalization was increased from 1,009,467 shares to 1,110,414 shares, which increase makes the total stock outstanding $55,520,700. The increase is authorized in accordance with the proposition to make a 10 per cent stock dividend, which was announced by the directors Dec. 4. After the special meeting the directors adopted a resolution providing that the 10 per cent scrip dividend be made payable March 1. The par value of this stock dividend is $5,047,335, but the market value is nearly $9,000,000. The United Gas Improvement Company controls a number of extensive and profitable electrical plants, in this respect rivaling the several Standard Oil gas companies.

Toronto Electric Light Company.—The annual report of the Toronto Electric Light Company for 1909 shows gross earnings of $1,292,545, and cost of operation of $716,838. The surplus for the year, after paying fixed charges, dividends and charging $200,000 to reserve, is $15,213. In his report to the shareholders, Sir Henry Pellatt, president of the company, stated that the business had steadily increased and that at the end of the year the installed load of the system showed the equivalent of 779,263 16-cp lamps. He said that the company was now in first-class condition and able to take care of all the business that is likely to be offered.

Cleveland Electric Illuminating Company.—Notice has been given by the Cleveland Electric Illuminating Company that, in accordance with the terms of the mortgage securing its first mortgage, 5-per cent bonds, of which there are $1,700,000 outstanding, the company expects to retire and redeem these bonds on April 1. Upon presentation and surrender at the office of the Morton Trust Company on that date, the holders will receive 110 and interest. The funds for the retirement of these bonds were secured from the sale a short time ago of $4,000,000 first and refunding 5-per cent bonds out of a total authorized issue of $30,000,000.

Pacific Light & Power Company.—The Pacific Light & Power Company, of Los Angeles, which now has authorized capital stock of $40,000,000, will shortly begin work enlarging several of its plants so as to meet the increasing demands for energy. The capacity of the plant at Redondo will be doubled by the addition of three units of 7500 hp each. The company also proposed to develop more power on Kern River and to extend its lines into the mountains where additional plants will probably be constructed.

Mergers of Telephone Companies.—A certificate has been filed at Trenton, N. J., merging the Delaware & Atlantic Telephone Company, of New York, and the Delaware & Atlantic Telegraph & Telephone Company, of New Jersey, under the name of the latter company, without change of capital stock or officers of the New Jersey corporation. A certificate has also been filed for the merger of the Northeastern Telephone & Telegraph and the New York Telephone & Telegraph Company.

Westchester Northern Railroad Company.—Articles of incorporation have been filed in Albany for the Westchester Northern Railroad Company, which is authorized to operate a steam or electric railroad 45 miles long, of which 35 miles are to be in New York and 10 miles in Connecticut. This company is organized to take over and operate that portion of the Tarrytown, White Plains & Mamaroneck Railway property which was purchased by the New York, New Haven & Hartford Railroad Company.

Detroit Edison Company.—A special meeting of the stockholders of the Detroit Edison Company will be held in New York City on Feb. 23 to vote on a proposal to increase the capital stock from $6,000,000 to $9,000,000, and to authorize an issue of $3,000,000 of debenture bonds convertible into stock. The disposal of the additional securities will be left to the discretion of the directors. The proceeds will be expended for improvements and extensions.

Southern New England Telephone Company.—The directors of the Southern New England Telephone Company, Boston, have decided to issue $1,099,400 of additional stock, to be offered to the present stockholders in the ratio of one new share for seven shares of the present stock. This new stock will not be issued until October, and will be paid for in two installments, the first of which will be due Jan. 1, 1911.

Camden & Trenton Railroad Company.—The United States Court of Trenton, N. J., has issued an order for a foreclosure sale of the property of the Camden & Trenton Railroad. The date of the sale has not yet been fixed. This action is favorable to the reorganization plan agreed to by the first and general mortgage bondholders committees.

Gas Business in Chicago.—For the year 1909 the Peoples Gas Light & Coke Company, of Chicago, reports the largest gross earnings in its history, being $14,561,588.50. Operating expenses were $8,504,596.63, leaving net earnings of $6,056,991.87. Deducting bond interest and allowances for depreciation, reserve, etc., there remained $3,113,103.51, equivalent to 8.89 per cent on the $35,000,000 capital stock of the company. Dividends were 6 per cent for the first quarter, and 7 per cent for the remainder of the year. The surplus for the year is $781,067.01. In his annual report President George O. Knapp refers to the substantial progress on the large and handsome building which the company is erecting at Michigan avenue and Adams street. He also says that the work done in the last two years to regulate the distribution and pressure of gas is showing good results. But perhaps additional changes may be necessary to secure the best results. The following statistics, as of December 31, 1909, are of interest: Street mains in service, 2,484 miles, being a gain of 118 miles for the year; number of meters, 496,615, gain of 27,531; gas stoves, 279,080, gain 24,718; public lamps 17,630, loss 3,455; arc lamps 84,335, gain 9,210. Thus the greatest proportionate increase is in the use of gas for cooking, while street lighting shows a loss to electricity. As a whole, the report is an excellent one for the company making it, and it shows how the gas business is making progress in Chicago, side by side with one of the most progressive electric service companies in the city, whose business is increasing by leaps and bounds. For comparison, it may be mentioned that the gross earnings of the Commonwealth Edison Company for the year ended September 30, 1909, the date of the last annual report, were $10,639,446.50.

International Smelting & Refining Company.—A quarterly dividend of 2 per cent has just been declared upon the stock of the International Smelting & Refining Company, placing it upon an 8-per cent basis. The dividend is payable March 1. The International Smelting & Refining Company was organized about a year ago with an authorized capital stock of $50,000,000, of which only $10,000,000 has been issued. About forty per cent of the stock is controlled by the United Metals Selling Company. A large amount is also held by the Utah Consolidated Company. Last year the company's earnings were equivalent to over 13 per cent on the stock, which was on an investment of $6,500,000, and derived principally from the Raritan Copper Company plant at Perth Amboy. During the coming spring a new smelter, which is now being completed in Utah, will be put in operation, and the earnings of the company are expected to be between 15 and 20 per cent on the capital stock.

North American Company's Notes.—The North American Company has issued a notice that it will purchase at par and accrued interest $1,000,000 of its 5 per cent collateral trust notes, in addition to the $200,000 of these notes which the company has already secured. The retirement of these notes is optional with the holders at the present offer, as the company cannot call them at less than 101 and accrued interest. The notes mature May 1, 1912, and $2,500,000 were originally sold out of an authorized issue of $5,000,000. The funds for the present retirement are derived from the proceeds of the sale of the company's holdings in the Laclede Gas Company.

Morgan Interests in Ohio Telephones.—At the annual meeting of the stockholders of the Columbus Citizens' Telephone Company late last week, Mr. Stevens, of J. P. Morgan & Company; N. Monsarrat, president of the Hocking Valley Railroad Company, and W. K. Field, president of the Sunday Creek Company, were elected directors. Both the Hocking Valley Railroad Company and the Sunday Creek Company are supposedly Morgan interests, and in that way his representatives in the board of this company are more numerous than in any of the others.

Niagara & Erie Power Company.—Application has been made to the Public Service Commission of the Second District of New York by the Niagara & Erie Power Company for permission to issue $100,000 of stock and $1,250,000 of 5 per cent bonds. The company proposes to operate a transmission system through the counties of Erie, Chautauqua, N. Y., and Erie County, Pa. It takes over part of the property of the Buffalo & Lake Erie Traction Company and of the Buffalo & Ontario Power Company.

Interstate Power Company.—The Interstate Power Company, newly organized at Anderson, S. C., has filed a mortgage for $5,000,000 in favor of the Carnegie Trust Company, of New York, to secure an issue of bonds of a similar amount. It is understood that the company has acquired the property of the Savannah River Power Company, and proposes to develop the water power at Middleton Shoals, and also some other properties along the Savannah River in South Carolina.

Ohio Gas Merger Approved.—The directors of the Columbia Gas & Electric Company at Cincinnati last week approved the financial deal with the East Ohio Gas Company, a subsidiary of the Standard Oil Company, by which the two Cleveland gas properties belonging to the Columbia Company were merged with the East Ohio Company. This consolidation was given in detail in our issue of Jan. 27.

Indiana Traction Merger Considered.—It is stated that a movement is on foot at Indianapolis to merge all of the interurban and street car interests in Northern Indiana into one immense system. If the deal is consummated, through electric service will be maintained between Chicago, Indianapolis, Dayton, South Bend and as far as Cincinnati. It is proposed to establish dining and sleeping-car service as well.

New Jersey Public Service Corporation Bonds.—The Public Service Corporation of New Jersey has filed with the Secretary of State at Trenton, certificates showing that new bond issues amounting to $697,000 have been secured by a mortgage held by the Fidelity Trust Company, of Newark, which covers the property of subsidiary companies.

New York Edison Directors.—The four new directors which were added to the Board of the New York Edison Compan last week were Messrs. George F. Baker, George B. Cortelyou, William Rockefeller and John W. Sterling. All of these are members of the directorate of the Consolidated Gas Company.

Electric Securities at Auction.—At the auction of securities in New York last week 101 shares of the Washington Water Power Company, Spokane, Washington, "ex rights" $190 each were sold at 130½.

DIVIDENDS.

Kings County Electric Light, Heat & Power Company, quarterly, 2 per cent, payable March 1.

North Texas Electric Company, preferred, semi-annual, 3 per cent; common, semi-annual, 2 per cent, payable March 1.

Philadelphia Electric Company, quarterly, 1½ per cent, payable March 15.

Portland (Ore.) Railway, Light & Power Company, quarterly, 1 per cent, payable March 1.

Rochester Railway & Light Company, preferred, quarterly, 1¼ per cent, payable March 1.

Seattle Electric Company, preferred, semi-annual, 3 per cent, payable April 1; common, semi-annual, 1¾ per cent, payable April 15.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American District Telegraph Company (of New Jersey):					
Year 1909 (December, estimated)	$3,600,000	$2,700,000	$900,000	$398,496	$501,504
Year 1908	3,192,000	2,407,000	785,000	398,912	386,912
Chicago Telephone Company:					
Year 1909	9,907,450	7,686,742	2,220,708	2,160,000	60,708
Year 1908	8,741,517	6,668,176	2,073,341	2,012,790	60,551
Metropolitan West Side Elevated Railroad Company, Chicago:					
Year 1909	2,818,431	1,418,076	1,411,514	1,062,596	348,918
Year 1908	2,746,840	1,410,801	1,346,165	1,084,750	261,415
New York, New Haven & Hartford Railroad Company:					
Quarter ended Dec. 31, 1909	15,528,904	9,732,774	5,796,129	5,461,983	2,323,537
Quarter ended Dec. 31, 1908	13,901,609	9,703,036	4,198,572	4,914,161	916,214
Pacific Telephone & Telegraph Company:					
Year 1909	12,885,018	11,041,489	1,843,529	1,080,000	763,529
Year 1908	10,699,650	8,924,179	1,775,471	1,080,000	695,471
People's Gas Light & Coke Company, Chicago:					
Year 1909	14,561,588	8,504,596	6,056,992	1,909,300	4,147,692
Year 1908	13,738,970	8,222,625	5,516,345	1,884,300	3,632,045
St. Joseph (Mo.) Railway, Light, Heat & Power Company:					
January, 1909	89,307	46,906	42,401	22,017	20,384
January, 1908	79,435	41,838	37,597	20,638	16,959

General News

Construction News.

ALBERTVILLE, ALA.—It is reported that the Sand Mountain Electric Company is contemplating the early purchase of additional equipment for its plant, including a tubular boiler.

BRIDGEPORT, ALA.—Plans are being prepared by the Bridgeport Electric & Railway Company for a power plant, bids for which, it is said, will soon be called. The equipment will include a 350-hp boiler plant, engine, 200-kw generator, exciter, switchboard and other apparatus.

MONTGOMERY, ALA.—J. F. Browder, chief of the Montgomery fire department, is advocating extensive improvements to the equipment of the fire department, which will involve an expenditure of $30,000, the greater portion of which will be expended for electrical equipment. The City Council is now considering the question.

OPELIKA, ALA.—At an election to be held March 28 the proposition to issue $85,000 for an electric light plant and water system will be submitted to a vote. L. F. Dickson is Mayor.

ROANOKE, ALA.—The city has purchased a water power site with 75-ft. fall, located seven miles north of the city, and proposes to develop about 150 kw to operate the municipal electric light system. It is also proposed to install motor-driven centrifugal pumps and filtering plant at the municipal water works system. For further information address W. Oscar Orr, superintendent.

BOONEVILLE, ARK.—The Booneville Light & Water Company is contemplating the construction of an electric power plant and pumping station to be operated by hydraulic turbines.

NASHVILLE, ARK.—The city is contemplating establishing an electric light plant and would like to correspond with parties interested. R. T. Adams is city clerk.

TRUMANN, ARK.—Plans are being prepared by the Singer Manufacturing Company for building a large cutting and veneer plant in Trumann, for which, it is reported, power and operating machinery will be required, including generators, engines, boilers, heaters, pumps, motors, etc.

LOS ANGELES, CAL.—The Pacific Light & Power Company, which was recently re-incorporated with a capital stock of $40,000,000, proposes to enlarge several of its plants to meet the increasing demands for electrical service. The first step taken by the company will be the doubling of the output of the plant at Redondo, at a cost of $1,750,000. The present equipment of the plant includes three units of 7500 hp each, and it is proposed to install three additional 7500-hp units. The company also proposes to develop more power on the Kern River, and to run new lines and build new plants in the mountains. W. G. Kirchoff is one of the incorporators.

MARYSVILLE, CAL.—The Pacific Gas & Electric Company is reported to have decided to build a tunnel under the mountains to take the place of about five miles of ditch and flume in connection with its hydro-electric power plant at Colgate. The tunnel will be between two and three miles in length.

MERCED, CAL.—It is reported that an electric power plant and other machinery will soon be purchased for the Ruth Pierce Mining Company at Harnitos, located near Merced.

OAKLAND, CAL.—Orders have been placed by the San Francisco, Oakland & San Jose Railway Company with the General Electric Company, Schenectady, N. Y., for a 2700-kw generator to be direct-connected to a Hamilton-Corliss engine furnished by Charles C. Moore & Company.

REDLANDS, CAL.—The Southern California Edison Company is reported to be preparing plans for the construction of another power plant in the Santa Ana Canyon, which will involve an expenditure of about $600,000. The plant will be located in Lost Man's Canyon and will have an output of 7000 kw. This will give the company six plants in Santa Ana Canyon above Redlands, with a total output of 16,000 kw.

SANTA CRUZ, CAL.—The City Council has adopted a resolution providing for municipal improvements which will involve an expenditure of about $160,000 and include the installation of a new lighting plant, reservoir, extension to water-works system, chemical fire engine, street improvements, etc.

COLORADO SPRINGS, COL.—Preparations are being made by the Colorado Telephone Company for installing a cable system between Ivywild and Broadmoor and for other improvements, which will involve an expenditure of about $25,000. R. F. Morris is district manager.

DENVER, COL.—Rights-of-way are being secured for an electric railway to extend northward from Steamboats Springs to Hahn's Peak, Farwell Mountain and the Three Fork mining district of Colorado and Wyoming. Joseph Monnette, of Lawrence, Mass., and J. W. Emard, of Montreal, Que., Can., are interested in the project.

FOWLER, COL.—The question of establishing an electric light plant in Fowler is under consideration. G. E. Miles is interested in the project.

GREELEY, COL.—Preparations are being made by the Northern Colorado Telephone Company to run a cable to Greeley; from there it will be extended to Eaton, Ault and Windsor. The improvements to be made by the company in this vicinity will cost about $135,000.

WILMINGTON, DEL.—At the annual meeting of the West Chester & Wilmington Electric Railway Company definite arrangements were made for the construction of its proposed electric railway to connect Wilmington and West Chester, for which surveys have been made and rights-of-ways secured. C. P. Faucett, of West Chester, Pa., is secretary and treasurer.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., for furnishing four wireless telegraph sending sets, under circular (No. 421), in accordance with drawing No. 790 and specification No. 525.

WASHINGTON, D. C.—Bids will be received at the office of the general purchasing officer of the Isthmian Canal Commission, Washington, D. C., until Feb. 25 for furnishing electrical material, including fixtures, fittings, cable, wire, line material, lineman's tools, hardware, mica, soldering material, insulating material, paint, varnish, japan, conduit, molding, rubber gloves, tape, etc. Blanks and general information relating to this circular (No. 562) may be obtained at the above office. Bids will also be received at the above office until Feb. 21 for furnishing 12 double friction drum hoists, electrically operated. Captain F. C. Boggs is general purchasing officer.

MARIANNA, FLA.—It is reported that new equipment will be purchased for the electric light plant and pumping station in the near future, for which bonds to the amount of $10,000 were recently voted.

SOUTH JACKSONVILLE, FLA.—The city is asking for proposals for an electric light franchise. R. V. Rogero is city clerk.

ATHENS, GA.—The Athens Electric Railway Company has awarded the contract for the construction of a reinforced dam of the gravity type at Barnett Shoals, Ga., to the Ambursen Hydraulic Construction Company, of Boston, Mass.

LA FAYETTE, GA.—The City Council is considering the question of establishing an electric light plant and solicits correspondence with parties interested. C. J. Hammond is city clerk.

OLIVER, GA.—The Oliver Electric Power Company, recently incorporated, is planning to construct a power plant in Oliver, to cost about $15,000. D. G. Zeigler & Company, of Jacksonville, Fla., are engineers.

TOCCOA, GA.—The Toccoa Falls Light & Power Company, it is said, will purchase an alternating-current generator in the near future.

WILLACOOCHIE, GA.—The contract for the construction of the municipal electric light plant has been awarded to J. B. McCrary & Company, of Atlanta, Ga.

DIXIE, IDAHO.—S. R. Gayton, of Philadelphia, Pa., who has purchased the Dixie townsite, is contemplating the installation of an electric light plant during the coming summer. Mr. Gayton is connected with the Penn-Dixie Mining Company.

GRANGEVILLE, IDAHO.—The City Council has granted the Pacific Telephone & Telegraph Company a franchise to erect a telephone system in Grangeville, under the terms of which the company is to spend $8,000 in this city within a year.

WALLACE, IDAHO.—Plans are being considered by C. A. Wing, of Wallace, Idaho, for installation of machinery at his Oro Monarch Mine, including crushing equipment, a 40-stamp battery and power apparatus during the coming year.

CHICAGO, ILL.—The Madison Light Company of Chicago has applied to the City Council for a franchise to construct and operate a system for the transmission and distribution of electricity and steam in the territory bounded by Randolph, Madison, Dearborn and Clinton streets. The company proposes to install a plant in the basement of the new building to be erected at the corner of Market and Madison streets by William R. Hearst.

DECATUR, ILL.—Equipment will soon be required for the new electric plant to be erected by the Progressive Electric Company, of Decatur, Ill., consisting of boilers, engine, generators, condenser, pumps, switchboard, etc.

JOLIET, ILL.—The power plant at the State penitentiary at Joliet, Ill., was destroyed by fire Feb. 3, causing a loss of about $100,000.

KANKAKEE, ILL.—The construction of a large dam and hydro-electric power plant on the Kankakee River in Wilmington, located about two miles below the Kankakee County line, is under consideration by A. N. Powers, promoter of the Illinois Light & Power Company. Applications have been made for 50-year franchises in Bourbonnais, Bradley and Kankakee to furnish electricity for lamps and motors. Later the syndicate will ask for permission to build an interurban railway between Kankakee and Joliet, following the Kankakee River to Wilmington.

MASON CITY, ILL.—The City Council has granted a franchise to A. E. Abbott, of Mason City; Richard and Ira Abbott, of St. Petersburg, Ill., to erect electric transmission lines in Mason City.

PETERSBURG, ILL.—Preparations are being made to extend the transmission lines of the Petersburg electric light plant to several towns. It is also proposed to increase the equipment of the plant by the installation of an alternating-current, three-phase, 2200-volt generator, one 300-hp engine and a water tube boiler with a rating of 300 hp. Material for 24 miles of transmission line will also be required. R. H. Abbott is president and manager.

ANDERSON, IND.—The capital stock of the Welchel Electric Company has been increased from $25,000 to $50,000, the proceeds to be used to enlarge the plant and business of the company. B. Welchel is president.

BEECH GROVE, IND.—Preparations are being made by the Big Four Railroad Company for extensive improvements and additions to its shops at Beech Grove, Ind., which will involve an expenditure of about $1,000,000. The work includes an addition to the power plant with sufficient space to accommodate several 1500-kw turbo-generator sets.

BEECH GROVE, IND.—The Beech Grove Traction Company has been granted a franchise by the Town Board to construct and operate an electric railway through this town and to connect Beech Grove with Indianapolis. Work on construction of the railway will commence as soon as the weather will permit. W. H. Ogan is president.

CARTHAGE, IND.—The Carthage light and water plant will be sold at auction April 16 by H. O. Henley, receiver of the Light, Heat & Power Company, which furnishes electricity and water to the city. Disagreement among the owners is the reason of the appointment of a receiver and the sale of the property.

COLUMBUS, IND.—The National Light, Heat & Power Company, of New York, N. Y., of which the Central Indiana Lighting Company is a subsidiary, has entered into a contract with the Westinghouse, Church, Kerr Company, of New York, N. Y., for extensive improvements to its local systems, which will include extensions to the lighting and power service and street railway system. The Westinghouse company recently erected a large power house for the Central Indiana Lighting Company in this city. The old power plant will be dismantled as soon as a transformer can be installed in the new power house to furnish service for the street railway.

DECATUR, IND.—The Decatur Southern Traction Railway Company is planning to commence work within the next four months on its proposed electric railway, which is to connect Decatur and Pana and intervening towns, 35 miles in length. The power plant and repair shops will be located in Decatur. The capital stock is placed at $25,000. Peter Chase, of Decatur, Ill., is vice-president and general manager.

FORT WAYNE, IND.—The Monarch Fertilizer Company, it is reported, will soon be in the market for a large electric crane and an electric hoist to be used in connection with its proposed new plant.

HOBART, IND.—O. L. Shore, manager of the municipal electric light plant, writes that two new boilers will be installed in the plant early this year.

INDIANAPOLIS, IND.—The Indianapolis, Crawfordsville & Western Traction Company is reported to be planning to extend its railway from Crawfordsville to Veedersburg.

INDIANAPOLIS, IND.—The Merchants' Heat & Light Company has secured the contract to furnish electricity to light the State House, State House grounds and the streets bordering the grounds. The contract is only for one year, as it is expected that the next Legislature will make an appropriation for the construction of an electric plant to furnish electricity to light the State House, State soldiers' monument and six State Hospital buildings within a radius of seven miles from the capital.

LAFAYETTE, IND.—Plans are being prepared by the Thomas Duncan Electric Company for the construction of a new plant. Equipment for the plant, it is said, has not yet been fully decided upon.

PERU, IND.—The City Council is considering the question of installing new machinery in the municipal electric-light plant and waterworks system. T. E. Dunn is city clerk.

REDKEY, IND.—A site has been purchased in Redkey by the Electrical Pressed Steel Company, of Dayton, Ohio, on which it will erect a new factory. The company proposes to furnish electricity for lighting the town.

SOUTH BEND, IND.—The Southern Michigan Railway Company is planning to extend its system to Buchanan, a distance of four miles.

SOUTH BEND, IND.—The Long Distance Telephone Company has issued $50,000 in capital stock, the proceeds to be used for extensions and improvements to the system.

DAVENPORT, IA.—The People's Light Company has applied to the City Council for a franchise to construct and operate an electric light plant in Davenport.

DAVENPORT, IA.—We are informed that the Davenport Water Power Company will commence work on the construction of its proposed plant early in March. The company proposes to utilize the water power of the Davenport-LeClaire Rapids in the Mississippi River. The cost of the plant is estimated at about $2,000,000. Charles Francis is engineer in charge.

DENISON, IA.—It is reported that local business men are contemplating the construction of a dam on the Boyer River.

GRAND JUNCTION, IA.—G. W. Nicholson Company, owner of the local electric light plant, contemplates installing an entire new plant this coming spring. Wilbur W. Wertz is secretary and manager.

MARSHALLTOWN, IA.—It is reported that G. M. Law, of St. Louis, Mo., has purchased the plant and holdings of the Peterson Heat, Light & Water Company and proposes to build a power house in the heart of the city. The heating system, it is said, will be changed from hot water to steam.

MASON CITY, IA.—Arrangements are being made by the Farmers' Co-operative Brick & Tile Company, recently organized, for the construction of a new brick-making plant, the equipment of which will include a Corliss engine, boilers, crushing and grinding machinery, presses, etc. The plant may be equipped to be operated by electricity.

MILFORD, IA.—At an election held recently the proposition to establish a lighting system was carried.

SIGOURNEY, IA.—At an election to be held March 28 the proposition to issue a franchise to J. F. Dray to construct and operate an electric light plant in Sigourney will be submitted to a vote.

SIOUX CITY, IA.—The Sioux City & Spirit Lake Railway Company is reported to be contemplating the construction of a new power house and substations and will require equipment for same including steam turbines and generators with a rating of 4000 hp, tubular boilers, condensers, pumps, heaters, transformers, rotary converters, switchboards, etc.

EUREKA, KAN.—Preparations are being made by I. R. Scammahorn and J. D. Henderson, owners of the local electric-light plant, for improvements to the local system, which will include the installation of an additional engine and generator. A day service will be established this spring.

GARNETT, KAN.—Plans are being made by the McAfee Manufacturing Company to enlarge and improve its electric power plant.

MILDRED, KAN.—The Great Western Portland Cement Company, it is reported, is planning to install an alternating-current generator driven by a 1200-hp engine, together with auxiliary machinery in its power plant at Mildred.

SABETHA, KAN.—Bonds to the amount of $65,000 have been voted for the installation of a water works system, which will be in operation by Sept. 1, 1910. Extensions will also be made to the municipal electric light plant, which will include the installation of a new 66-in. x 16-ft. boiler and oil burning equipment in the boiler room. Three panels will be added to the switchboard. The water will be lifted from four deep wells by four 5-hp motor-driven power heads and pumped into a 200,000-gal. concrete reservoir; a 70,000-gal. tank will be erected on a 125-ft. tower. Two 450-gal. turbine pumps each direct connected to 40-hp motors will also be installed. G. E. Johnson is manager.

WILSON, KAN.—The Wilson Electric Light Company is contemplating remodeling its plant during the coming summer and establishing an all-night service. Messrs. Weber & Peirano are owners.

COLUMBIA, KY.—The Myers Electric Light Company is contemplating extensions and improvements to its plant, which will include the installation of a four-valve Corliss or automatic engine rated from 100 to 150 hp.

GUTHRIE, KY.—The local electric light plant, which was recently sold at auction, was purchased by the Clarksville Trust Company. The plant will continue to be operated under the present management.

MIDDLESBORO, KY.—The Kentucky-Tennessee Telephone Company, recently incorporated, has commenced work on the erection of a copper trunk line from Middlesboro to Knoxville, Tenn., via LaFollette.

MOUNT VERNON, KY.—The citizens are contemplating the construction of a municipal electric light and power plant in Mount Vernon during the coming summer.

THIBODAUX, LA.—Plans are being considered for extensive improvements to the municipal electric light plant, which will include the installation of series tungsten lamps to replace the present arc lamp system and three direct connected units of 60-kw each, bids for which will soon be called. A day service will be established to be in operation from May to October. It is expected to have the alternating-current plant in operation within the next six months. R. N. Naquin is manager.

AUGUSTA, MAINE.—Work has commenced on the construction of the new electric power house for the Edwards Manufacturing Company in this city.

BELFAST, MAINE.—The City Council has awarded the contract for street lighting to the Penobscot Bay Electric Company, for a period of five years, under the terms of which the company is to furnish 315 60-cp tungsten lamps at the rate of $15 per lamp per year and five 2000-cp arc lamps at $75 each per year.

SKOWHEGAN, MAINE.—Plans are being made by the Kennebec Development Company for the development of the water-power of Kennebec River by which it is estimated that about 90,000 hp can be developed at a cost of about $9,000,000, work on which will begin in the spring. The plans call for the construction of three large dams, the first of which will be located at Indian Pond, a short distance below Moosehead Lake's outlet, where the two outlets come together. Electricity generated at the plant will be transmitted throughout the State. It is said that 30,000 hp has been already contracted for. O. H. Briggs is president.

BALTIMORE, MD.—A bill will be presented to the State Legislature by Harry C. Saunders asking for a charter for the Baltimore Light, Heat & Power Company, which is now doing business under a municipal franchise granted by the City Council. The bill provides for a consolidation of interests with the Baltimore Heating & Refrigerating

Company, which is now in the hands of receivers. The company will be capitalized at $500,000. The incorporators are: Michael Schloss, John W. Snyder and Joseph R. Gunther, of Baltimore, Md.; Charles H. Burr, of Pennsylvania, and Charles R. Bishop of New York.

REISTERSTOWN, MD.—A bill has recently been introduced into the Senate to incorporate the Baltimore & Pennsylvania Railway Company, which proposes to construct an electric railway from Reisterstown to Hanover, Pa. Permission is given the incorporators to acquire the franchise of the Hempstead & Manchester Railway. The capital stock of the company is placed at $600,000, and the incorporators are: James H. Wilson, Jacob H. Sherman, Jacob A. Frederick, Newton S. Watts and William T. Deitrich.

BOSTON, MASS.—The School Commissioners have taken the first step toward the installation of independent electric lighting systems for school buildings by adopting an order directing the auditor to notify the Edison Electric Illuminating Company to discontinue its service in the Mechanics Arts High School upon completion of the switchboard connection with the electric plant now located in the building. A contract will be made with the Edison company for auxiliary service. The School Commissioners have been authorized to prepare plans for the new buildings to be occupied by the High School of Commerce, with provision for the installation of an independent lighting plant.

HAVERHILL, MASS.—The Haverhill Electric Company has submitted a proposition to Mayor Moulton offering to make a reduction in its rates for electrical service in this city providing the proposition to establish a municipal electric lighting plant is abandoned. Under the present contract with the company, which has three more years to run, the city pays $100 per year per lamp. The company agrees to reduce this price to $96 per arc lamp per year. If a new 5-year contract is made at once, the company offers to reduce the price to $91.20 per lamp per annum, or if a 10-year contract is made, to $86.40 each per year. It also agrees to reduce the rate to all consumers of electricity from 15 cents to 12 cents per kw-hour as soon as the Council votes negatively on municipal ownership of the lighting plants. The Haverhill Gas Company has also submitted a proposition offering to reduce the price of gas from $1 to 90 cents per 1000 cu. ft. and a further reduction to 85 cents when the consumption reaches 325,000,000 cubic feet. Henry T. Sands is general manager of the Haverhill Electric Company.

HOLYOKE, MASS.—The lighting department has applied to the Board of Aldermen for an appropriation of $125,000 for further additions to the lighting department, of which $100,000 is for the electric-light plant. W. H. Snow, manager, recommends the installation of four more new boilers with stokers and replacing the present 500-kw generator with a 2500-kw generator with its accessories of condensers and pumps.

PITTSFIELD, MASS.—The Pittsfield Electric Company is contemplating enlarging its power plant and increasing the output by 1000 kw. W. A. Whittlesley is superintendent.

ROWLEY, MASS.—The selectmen have been petitioned to call a town meeting to vote on the proposition to install an electric light plant in Rowley.

TURNERS FALLS, MASS.—Preparations are being made by the Turners Falls Company to double the output of its plant by the installation of a 1000-kw alternating-current generator and hydraulic turbine, together with auxiliary apparatus.

UXBRIDGE, MASS.—Preparations are being made by the Uxbridge & Northbridge Electric Company to enlarge its power plant to meet the increase in demand for electrical service. The work will include an addition to the power house; the installation of a 500-kw, three-phase turbo-generator set, for which a contract has been let; a new switchboard and transformer.

WEST BOYLSTON, MASS.—The contract for the construction of the municipal electric light plant has been awarded by the selectmen to the Delta Electric Company, of Worcester, Mass., for $13,479. The work includes the construction of pole lines and substation, to be completed by July 1, 1910.

WEST MANSFIELD, MASS.—Arrangements are being made by the Massachusetts Coal & Power Company for the construction of a new plant in West Mansfield, Mass., for which equipment will be required in about six months, including a Corliss engine, generator, hoisting engine and coal-handling machinery.

DETROIT, MICH.—A special meeting of the stockholders of the Detroit Edison Company will be held Feb. 23 to vote on the proposition to increase the capital stock from $6,000,000 to $9,000,000 and to authorize an issue of $3,000,000 of convertible debenture bonds. The proceeds will be used for improvements and extensions to its system.

FLINT, MICH.—Plans are being prepared by the Auto Top Manufacturing Company for the erection of a factory in Flint, which will include electric power equipment.

GRAND LEDGE, MICH.—The Trask Knitting Company, of Williamston, Mich., is reported to be preparing plans for the construction of a factory in Grand Ledge, which will probably be operated by electricity.

GRAND RAPIDS, MICH.—Plans are being prepared by the Grand Rapids-Muskegon Power Company for extending its service during the coming year to Berlin, Spring Lake, Kent City, Casnovia, Grant and Sparta. The company may also extend its service to North Park and Mill Creek.

KALAMAZOO, MICH.—The American Sign Company is reported to be considering the construction of a factory in the near future to be equipped for electrical operation in Kalamazoo.

KALAMAZOO, MICH.—The Commonwealth Power Company is making arrangements to erect a large power plant in Kalamazoo, a site for which has been purchased. The proposed plant will be steam driven, and will furnish electricity for operating the Michigan United Railways and for lamps and motors in Kalamazoo, Battle Creek and a number of small towns. It is expected to have the plant completed by Jan. 1, 1911. J. B. Foote, of Jackson, Mich., is general manager.

MUSKEGON, MICH.—The Continental Motor Manufacturing Company is planning to erect a new factory, for which motor-driven machine tools and other equipment will be required.

OWOSSO, MICH.—Two franchises have been submitted to the City Council for approval, one by the Commonwealth Power Company, of Jackson, Mich., asking for permission to erect a power station in this city and to furnish electrical service for a term of 30 years; the other by T. W. Atwood, a stockholder of the Michigan United Railway Company, asking for a 30-year franchise to construct and operate a street railway over certain streets in Owosso. The franchises must be submitted at a city election to become effective. The railway company proposes to build an electric railway from Lansing to Saginaw, and to build branch lines from Owosso to Durand and Flint.

PONTIAC, MICH.—The Michigan State Telephone Company is contemplating extensive improvements to its local system, which will involve an expenditure of about $25,000.

STURGIS, MICH.—We are informed that Prof. Gardner S. Williams, of Ann Arbor, Mich., has been engaged by the city to take charge of the proposed improvements to the municipal electric-light plant. A. R. Newman is city clerk.

TRAVERSE CITY, MICH.—The Brown Lumber Company is contemplating the installation of electric motor driven machinery for its proposed new factory.

BLOOMING PRAIRIE, MINN.—The L. G. Campbell Manufacturing Company is reported to be contemplating the purchase of a 200-hp tandem-compound condensing Corliss engine with steam generating plant complete.

CANNON FALLS, MINN.—The contract for construction of dam (50 ft. high and 500 ft. long), with power-house, near Cannon Falls, Minn., for the Consumers' Power Company has been awarded to the Ambursen Hydraulic Construction Company, of Boston, Mass. H. M. Byllesby & Company, of Chicago, Ill., are engineers.

FAIRFAX, MINN.—The question of issuing $5,000 in bonds for the installation of an electric lighting system is under consideration.

GILBERT, MINN.—At an election held recently the citizens voted to issue bonds to the amount of $15,000, the proceeds to be used for completing the lighting and water systems.

INTERNATIONAL FALLS, MINN.—The contract for installing electric fixtures in the new court house has been awarded to Charles Wilkins & Company, of Minneapolis, Minn., for $1,500.

MAZEPPA, MINN.—Plans are being considered by the Zumbro Power Company for the construction of a dam 50 ft. in height across the Zumbro River and the installation of hydroelectric power plant in the towns of Mazeppa and Zumbro.

NORTHFIELD, MINN.—The plant and holdings of the Northfield Light, Heat & Power Company have been purchased by the Cannon Valley Electric Company. It is understood that extensive improvements will be made.

REDWOOD FALLS, MINN.—R. F. Wherland is reported to be interested in a project to organize a company under the name of the Wherland Electric Company for the purpose of supplying electrical service in Wherland and surrounding towns. Electricity for operating the system will be secured from the Redwood Falls electric power plant.

MEXICO, MO.—Work has commenced on the construction of the power-house and electric railway of the Mexico, Santa Fe & Perry Traction Company in Mexico. The J. J. Burns Construction Company, of Chicago, Ill., has the contract.

ST. LOUIS, MO.—It is reported that Charles Wassmath & Sons, of St. Louis, Mo., are contemplating the installation of a new power plant for which boiler plant, engine, generator and other machinery will be required.

SMITHVILLE, MO.—The contract for rebuilding the plant of the Smithville Electric Light Company has been awarded to Harry Weldin. The equipment will include crude oil engines, one 75-kw, three-phase, 1100-volt generator and 25-kw, step-up transformer. Harry Gordon is manager of the Smithville Electric Light Company.

TRENTON, MO.—The City Council has adopted a resolution to submit the proposition to issue bonds for the establishment of a municipal electric light plant to a vote at the April election. O. G. Williams is Mayor.

BUTTE, MONT.—Arrangements have been completed for the construction of the proposed electric railway between Butte and Helena, work on which will commence in the spring.

LEWISTOWN, MONT.—We are informed that bids will be called about April 1 for the construction of the proposed electric light plant in Lewistown, Mont., of which J. L. Bright is president. The cost of the plant is estimated at $150,000.

WEEPING WATER, NEB.—The question of establishing a lighting system in Weeping Water is under consideration.

CLAREMONT, N. H.—Plans have been completed for equipping the entire plant of the Monadnock Mills for electric-motor drive. Orders have been placed for a 500-hp steam turbo-generator set and other equipment.

NEWARK, N. J.—The Public Service Corporation of New Jersey has recently placed contracts with the Westinghouse Electric & Manufacturing Company and the General Electric Company for machinery for its power houses and substations, which will involve an expenditure of more than $500,000. The contract calls for generating machinery rated at 15,000 kw, which will replace apparatus of 2000 kw, giving an increase of 13,000 kw. The company proposes to close the old Wayne Street station in Jersey City.

DEMING, N. M.—Arrangements are being made by the Deming Ice & Electric Company for increasing the output of the plant, which will include the installation of two boilers of 250 hp each and a steam turbo-generator set. The capacity of the ice plant is to be doubled. E. A. Lane, of Deming, is manager.

FORT BAYARD, N. M.—Sealed proposals will be received by Captain S. P. Vestal, constructing quartermaster, until March 15 for the construction, plumbing, heating, electric light wiring and electric light fixtures for one double and one single ward building, three double and one single officers' quarters. A deposit of $10 will be required to guarantee the return of plans and specifications.

BROOKLYN, N. Y.—The Edison Electric Illuminating Company is reported to be preparing plans to install additional equipment in its Pearl Street plant, which will involve an expenditure of $2,500,000.

BUFFALO, N. Y.—Application has been made by the Niagara & Erie Power Company to the Public Service Commission, Second District, for authorization to issue its capital stock ($100,000) and $1,250,000 in bonds. The company also asks for permission to have transferred to it certain property and franchises of the Niagara, Lockport & Ontario Power Company and the Buffalo & Lake Erie Traction Company, and also for permission to begin construction work. The latter companies have also applied for permission to make such a transfer. The Niagara & Erie Power Company proposes to operate an electrical transmission and distributing system, beginning at Gardenville, Erie County, and extending through the counties of Erie and Chautauqua, New York, and Erie County, Pennsylvania. The Niagara, Lockport & Ontario Power Company and the Buffalo & Lake Erie Traction Company propose to transfer their business of selling electricity to consumers to the Niagara & Erie Power Company, which has been organized for that purpose.

BUFFALO, N. Y.—The Niagara Machine & Tool Company is contemplating the construction of a plant in Buffalo, for which an electric generating unit, a large electric crane and motors for operating machinery, it is said, will be required.

HUDSON, N. Y.—Preparations are being made by the Knickerbocker Cement Company for the construction of a large plant in Fountain Head, which will be equipped with electric driven machinery throughout.

NIAGARA FALLS, N. Y.—The Cliff Electrical Distributing Company has been granted permission by the Public Service Commission, Second District, to increase its capital stock from $25,000 to $500,000, the proceeds to be used for acquiring rights, privileges and franchises now owned and controlled by the Niagara Falls Hydraulic Power & Manufacturing Company and also authority to exercise such rights and privileges. This order segregates the affairs of the Niagara Falls Hydraulic Power & Manufacturing Company, so that all matters that relate to public service will be taken care of by the Cliff Electrical Distributing Company. Bonds to the amount of $1,500,000 will be issued by the Cliff company.

SYRACUSE, N. Y.—Plans are being prepared by the Brown-Lope Gear Company for the construction of a large plant in Syracuse, including a separate power house with electric generating machinery. The company is successor to the Brown-Lope-Chapin Company.

WELLSVILLE, N. Y.—The Oak Duke Lumber Company is reported to be contemplating the installation of an electric generator for lighting its plant in Wellsville.

ASHEVILLE, N. C.—Locations have been made for the splash dams on the French Broad River, about two miles from Marshall, in connection with the $400,000 hydroelectric development of the W. T. Weaver Power Company, of Asheville, N. C. Work on construction of the dam will commence as soon as the weather will permit.

LOUISBURG, N. C.—The Portis Mining Company, which has purchased the Portis gold property, located in Franklin, about 20 miles from Louisburg, is contemplating the installation of a 7-ft. bucket gold dredge, 40 pulverizers and concentrators, pumping station with a daily capacity of 6,000,000 gal., 700-hp electric power plant, laborers' and officials' dwellings. The cost of the project is estimated at about $300,000. It is expected that contracts will be awarded about April 1. Alexander P. Rogers, of New York, N. Y., is consulting engineer. Maurice Brooke, 703 Empire Building, Philadelphia, Pa., is secretary of the company.

SALISBURY, N. C.—The Commissioners of Rowan County have granted a franchise to the Gold Hill Telephone Company, of Gold Hill, N. C., and to the Ebenezer Telephone Company, to operate telephone exchanges in Rowan County.

STATESVILLE, N. C.—Surveys are now being made by the Southern Power Company from Statesville to Lookout Shoals, on the Catawba River, 20 miles distant, where it is proposed to locate a hydroelectric power development. The present plans call for the construction of a dam and power house, to cost about $1,000,000. The site is located about 100 miles up the Catawba River and north of the first power site developed at Fort Mill on the South Carolina end of the stream.

WHITEVILLE, N. C.—Preparations are being made by the Whiteville Light & Power Company, recently organized, for the construction of an electric light plant.

WILSON, N. C.—The new plant of the Contentnea Guano Company, it is said, will be equipped for electrical operation, energy for which will be supplied by the municipal electric plant.

WINSTON-SALEM, N. C.—Preparations are being made by the Inverness Mills Company for the construction of its plant. The equipment will include 10,000 spindles and 300 looms. The mill will be equipped for electrical operation.

HARVEY, N. D.—Extensions and improvements will be made to the plant of the Harvey Electric Light & Power Company, which will include the installation of a boiler, heater, engine and generator and also panel to switchboard. A day service will be established. C. R. Cummings is manager.

LIDGERWOOD, N. D.—Application has been made to the City Council by the Lidgerwood Mill Company for a franchise to install an electric light plant in Lidgerwood.

AKRON, OHIO.—The Firestone Tire & Rubber Company is contemplating the installation of a 2000-hp power plant in connection with a new factory, plans for which are now being prepared. The equipment will include boilers, generators, motors, lifting and conveying machinery and other apparatus.

CINCINNATI, OHIO.—It is reported that plans are being considered for enlarging the power plants of the Cincinnati Traction Company.

DELPHOS, OHIO.—Preparations are being made by the Delphos Home Telephone Company for extensive additions and improvements to its system.

LOGAN, OHIO.—The Logan Light & Power Company has recently purchased an additional 125-kw engine type alternating-current generator from the Allis-Chalmers Company, of Milwaukee, Wis., and an engine from the Harrisburg Foundry & Machine Company. The company is making preparations to establish a day service May 1, 1910. E. T. Wagenhals is general manager.

MINERAL CITY, OHIO.—The Federal Clay Products Company is contemplating the installation of an electric generator and engine in its plant.

NORWOOD, OHIO.—The City Council has passed an ordinance providing for an issue of $18,000 in bonds, the proceeds to be used for improvements and extensions to the municipal electric light plant. Bonds to the amount of $15,500 were recently authorized for improvements to the water works system.

TOLEDO, OHIO.—The Maumee Rapids Electric Company, recently incorporated with a capital stock of $350,000, has acquired the old power plant at Miami and will install new machinery using water power from the canal. The plant is expected to develop 3000 hp. The company also has water rights at Maumee and near the Providence dam at Grand Rapids and expects to build plants at these places in the future. The right to locate a pole line on the canal bank also goes with the State franchises, which will enable the new company to enter the heart of the city without a franchise from the Council. As yet the promoters have been unable to secure a franchise from the City Council to distribute electricity in Toledo. It was proposed to make the Central Heating & Lighting Company, which now has a limited franchise covering a few blocks in the vicinity of the Zenobia Building the distributing concern for the Maumee Rapids Electric Company, which will probably be carried out should the company be able to come to an agreement with the city. The incorporators of the company are: George W. Stevens, Charles S. Ashley, Grant Miller, Hugh W. Haslup and Eliot Norton. The charter gives the company the right to supply heat, light and power in Lucas, Wood, Fulton, Henry, Williams, Defiance, Paulding and Putnam Counties.

WARREN, OHIO.—The Warren-Niles Telephone Company has increased its capital stock from $100,000 to $200,000, the proceeds to be used for extensions and improvements to its system.

MEDFORD, OKLA.—At an election to be held March 8 the proposition to issue $18,000 in bonds for the construction of an electric light plant will be submitted to a vote.

MOUNTAIN VIEW, OKLA.—At an election to be held about March 1 the proposition to issue $45,000 in bonds, of which $20,000 will be used for construction of an electric light plant, $20,000 for sewer system and $5,000 for extension of water system, will be submitted to a vote. Plans for the proposed improvements have been prepared by the O'Neil Engineering Company, of Dallas, Tex. D. E. McBride is city clerk.

OKLAHOMA CITY, OKLA.—We are informed that the Oklahoma Railway Company expects to purchase one 2000-kw turbine, five 500-kw motor-generators and one 400-hp boiler. W. A. Haller is engineer.

OKLAHOMA CITY, OKLA.—Preparations are being made by the Oklahoma City & Suburban Railway Company for the construction of about 15 miles of interurban and suburban track. W. A. Hallen is engineer.

OKLAHOMA CITY, OKLA.—The New England Telephone & Telegraph Company, recently incorporated with a capital stock of $50,000 to

establish an automatic telephone in the city, it is said, will soon increase its capital stock to $250,000. E. C. Barnes, of Oklahoma City, is one of the directors.

POTEAU, OKLA.—Orders have been placed by the Poteau Light & Ice Company for new equipment for its generating station, consisting of a 75-kw Westinghouse two-phase, 2200-volt alternator direct connected to a 100-hp Ideal engine; a 100-hp Brownell boiler and other apparatus. A 24-hour service will be established April 1, 1910. L. L. Lansing is manager.

COTTAGE GROVE, ORE.—The Mayor has been authorized by the City Council to take steps to purchase equipment for a light plant.

COTTAGE GROVE, ORE.—The Cottage Grove Electric Company is contemplating the installation of a 500-hp Corliss engine and a 350-kw, three-phase, 60-cycle, 2300-volt generator and also a 400-hp water-tube boiler. C. M. Shinn is vice-president and manager.

MARSHFIELD, ORE.—The H. M. Byllesby Company, of Chicago, Ill., has purchased the plant and holdings of the Coos Bay Gas & Electric Company, which owns the electric light plants at Marshfield and North Bend, with a gas plant supplying both cities, located at the last named place. The Coos Bay Gas & Electric Company holds a 35-year franchise for gas and electricity at Marshfield and a 50-year franchise in North Bend for both gas and electricity.

ALLENTOWN, PA.—Plans are being considered by the Morgan Portland Cement Company for the installation of machinery for a 2000-bbl. plant. Provision will also be made for a 2000-kw power plant, the equipment of which has not yet been decided upon.

BRIDGEVILLE, PA.—Preparations are being made by the Flannery Bolt Company for the installation of additional equipment, including an electric power plant with an output of about 300 kw, contract for which has been placed.

CHESTER, PA.—The power plant of the Delaware River Steel Company at Chester, Pa., was damaged by fire Feb. 7.

PHILADELPHIA, PA.—The Common Council is considering plans for installing a new system of illumination for the central business streets between Vine and South streets and the Delaware and Schuyler rivers.

PHILADELPHIA, PA.—The American Railways Company is planning to equip the Scranton, Dunmore & Moosic Lake Railroad, which it has recently leased, for electrical operation. The railroad is 10 miles in length.

POTTSVILLE, PA.—Local capitalists are promoting the construction of an electric railway to connect Pottsville and Pine Grove, Tremont and Tower City with a large amusement park at Sivatora Falls. A project is also under way to build an electric railway to connect Pottsville with Shenandoah and other towns in the northern part of Schuylkill County.

SCRANTON, PA.—Preparations are being made to construct an electric railway from Binghamton, N. Y., to Scranton, Pa., a distance of 62 miles. It is reported that the railway of the Northern Electric Street Railway Company, of Scranton, 19 miles in length, may be acquired to form part of the system. Application will soon be made for a charter. J. K. Griffiths and C. H. Campbell are interested in the project.

PAWTUCKET, R. I.—The Pawtucket Electric Company has submitted a proposition to the Town Council of Lincoln for renewal of the street lighting contract. It is proposed to replace some of the present arc lamps with incandescent street lamps.

ANDERSON, S. C.—A trust mortgage for $5,000,000 has been filed by the Inter-State Power Company in favor of the Carnegie Trust Company. It is understood that the company has acquired the property of the Savannah River Power Company and proposes to develop the water power of Middleton Shoals and other properties along the Savannah River in the State of South Carolina. C. Elmer Smith is president of the Inter-State Power Company.

CHARLESTON, S. C.—Preparations are being made by the Charleston Consolidated Railway, Gas & Electric Company for extensive improvements to its system, which will involve an expenditure of about $100,000 and include the construction of four miles of track for the city electric railway system. It is expected that the work will be completed about Oct. 1, when it is proposed to double-track the electric railway to the Charleston Navy Yard, a distance of about seven miles. P. H. Gadsden is president of the company.

EASLEY, S. C.—The Southern Power Company has entered into a contract with J. M. Greer, president of the Easley Coton Mills, to furnish electricity to supplement the present power facilities for operating the mills and also for lamps for the mill village. The contract calls for 250 hp or more. A transmission line will be erected from Greenville to Easley to furnish electricity for the service.

GETTYSBURG, S. D.—The question of establishing an electric light plant and water works system to be owned by the city is under consideration. A committee, consisting of E. F. Gross, J. A. Lake and Prof. Jean F. Sargent, has been appointed to make investigations and secure estimates on cost of installing the plants and report at a mass meeting to be held Feb. 24.

TRIPP, S. D.—The local electric light plant and telephone system, owned by Philip Ehresmann, has been purchased by Sprecher and Emanuel Muller, of Parkston. The consideration is said to be $15,000.

CHATTANOOGA, TENN.—Preparations are being made by the Acme Malleable Iron Works for an addition to its foundry, which will be equipped with new machinery, a greater part of which will be motor driven.

FAYETTEVILLE, TENN.—The Fayetteville Ice & Coal Company has purchased the Bearden Mill property, located on the Elk River, one mile from Fayetteville, for $18,500. The acquisition of this property, it is said, will enable the Fayetteville Electric Light & Power Company, which is owned by the same interests, to furnish a day service for both lamps and motors. The company will take possession of the property April 1.

NASHVILLE, TENN.—An appropriation of $50,000 has been made for the installation of a central heating and lighting plant and other improvements at the Fisk University. George A. Gates is president.

PARIS, TENN.—Improvements are being made to the municipal electric light plant, which will double the output of the station. The city is in the market for two 125-hp direct-connected turbines, with auxiliaries. M. W. Younkin is manager.

ROGERSVILLE, TENN.—We are informed that the Rogersville Electric Light & Power Company would like to receive prices on electrical equipment as follows: 100-kw, alternating-current generator, switchboard, transformers, meters, etc. Vance G. Hale is general manager.

BANDERA, TEX.—A committee has been appointed by the Citizens' Club, of Bandera, to confer with the Metropolitan Steam & Electric Railroad Company in regard to building an electric railway from Boerne via Vandera to Hondo City.

TRINITY, TEX.—The Trinity Light Company is contemplating the installation of a 10-hp gasoline engine direct connected to an 8-kw, 220-volt generator. A. R. MacDonald is owner and manager.

RUTLAND, VT.—The Rutland Railway, Light & Power Company has entered into a contract with the Penrhyn Slate Company, of Fair Haven, to furnish electricity to operate the new mill that the Penrhyn Company is erecting in Hydeville. The service will be furnished from the Carvers Falls plant.

LYNCHBURG, VA.—Plans are being considered by Clem S. Leftwich, of Greensboro, N. C., for the construction of a hydroelectric power plant on James River at Judith's dam, four miles from Lynchburg, where it is estimated that from 2000 to 2500 hp can be developed. Electricity generated at the plant will be transmitted to Lynchburg.

COVINGTON, VA.—The Town Council is considering the question of erecting a municipal electric light plant to furnish electricity to light the streets and public buildings and for commercial purposes. A committee, consisting of G. W. Huntley, G. A. Payne, C. S. Shepherd and W. R. Mann, has been appointed to make investigations and secure estimates of cost of the same.

RICHMOND, VA.—The Richmond Forgings Corporation is reported to have made arrangements to secure electricity from a local plant to operate its works for the present.

COLVILLE, WASH.—Arrangements are being made by the Washington Marble Company for the construction of a large cutting and finishing plant, to be equipped with power driven saws, planers, grinders. The equipment will include boiler, engine, generator, motors, air compressors, etc.

SEATTLE, WASH.—The Board of Public Works has awarded the contract for the installation of cluster lamps on Broadway and North Broadway to C. F. McDonald, for $14,730.

SPOKANE, WASH.—Plans are being prepared by the Big Bend Water Power Company, of Spokane, Wash., for the construction of a 6000-hp hydroelectric power plant on the Spokane River, work on which will begin in the near future.

SPOKANE, WASH.—In order to insure a more absolute continuity of energy the Washington Water-Power Company is installing a storage battery adjoining the new Post Street substation. It is expected to have the battery in operation before next winter.

TACOMA, WASH.—Plans have been completed by the Tacoma Railway & Power Company for improvements to its system including the double tracking of the Point Defiance line, which will involve an expenditure of from $80,000 to $100,000. W. S. Dimmock is general manager.

FORT SPRING, W. VA.—We are informed that N. Wilson Davis, of Winchester, Va., engineer, will have charge of the construction of the hydroelectric power plant to be erected in Fort Spring. The cost of the plant is estimated at $50,000. B. F. Mann is interested in the enterprise.

GENTRY, W. VA.—The New River & Pocahontas Consolidated Coal Company is contemplating the installation of a 1500-hp steam turbo-generator set, together with auxiliary apparatus in its power house. It is also understood that the company will purchase a large supply of electrical mining tools and coal handling machinery during the year.

KINGWOOD, W. VA.—The Glade Lumber Company is reported to be contemplating the construction of an electric light plant. J. E. Stizinger, of Woodbine, is manager.

MILLVILLE, W. VA.—The Winchester & Washington Railway Company, of Winchester, Va., is reported to have awarded a contract to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for turbines and electric generator for its steam power plant on Shenandoah River, at Millville, at a cost of about $50,000. The plant will be used as an auxiliary to its hydroelectric power plant.

MOOREFIELD, W. VA.—A company is being organized to establish an electric power plant in Moorefield, for which a franchise was recently granted. H. O. Barncord, of Midland, Va., is interested in the project. It is said that machinery for the plant will soon be purchased.

APPLETON, WIS.—It is reported that the Wisconsin Traction, Light, Heat & Power Company is contemplating doubling the output of its steam power plant.

ASHLAND, WIS.—Plans and specifications are being prepared by the Ashland Light, Power & Street Railway Company for the construction of a power plant to be located near Mellen, Wis. The equipment will include hydraulic turbines, electric generators, transformers, governors, exciters, switchboard, motors and heating apparatus.

EAU CLAIRE, WIS.—The Chippewa Falls Railway, Light & Power Company has awarded the contract for the construction of its dam and power-house on the Red Cedar River at Cedar Falls to the Ambursen Hydraulic Construction Company, of Boston, Mass., work on which will begin at once. The dam will be 450 ft. long and 48 ft. high.

LA CROSSE, WIS.—Plans have been completed by the La Crosse Water Company for the construction of a large dam at the mouth of Rock Creek on the east fork of the Black River, which will provide for the storage of 6,007,067,600 cu. ft. of water which will be utilized by means of a 97-ft. head, and will develop 30,000 hp. This will be the third of a series constructed by the company which operates the Hatfield water power. Work will commence on the dam in the spring. On completion of the dam, it is said, that a second power house with an output of 14,000 hp will be erected about a mile above the "Omaha cut-off," just out of Black River Falls, located about eight miles below the present Hatfield power house.

MILWAUKEE, WIS.—The new plant of the C. A. Krause Milling Company, of Milwaukee, Wis., which will replace the one recently burned, will be equipped for electrical operation throughout. Electricity for operating the plant will be furnished by a steam turbo-generator set rated at about 500 kw. It is understood that boilers, condensers, pumps, blowers, elevating and conveying machinery will be required.

OCONTO, WIS.—The Farmers' Telephone Company has increased its capital stock to $20,000, the proceeds to be used for extension of lines to Stiles, Pensaukee, Abrams and Little River.

PLYMOUTH, WIS.—The capital stock of the Plymouth Telephone Company has been increased from $1,100 to $6,000.

EVANSTON, WYO.—We are informed that the Evanston Electric Light Company will be in the market for boilers in the spring and will also install another prime mover in its plant this coming summer. L. E. Reaney is manager.

CALGARY, ALTA., CAN.—Plans are being considered for increasing the output of the municipal electric plant by 2000 hp. It is yet undecided whether to purchase electricity from a transmission company which is erecting a power plant on the Bow River or to add to the present steam-power plant. The transmission company has applied for a 30-year franchise in Calgary and agrees to furnish electricity at the rate of $24 per year per horse-power, delivered at the switchboard of the municipal plant at 2200 volts. James F. McCall is chief engineer.

VANCOUVER, B. C., CAN.—The contract for the construction of about 9000 ft. of pipe lines for conveying water from the dam to the power house of the Vancouver Island Power Company for its Jordan River plant has been awarded to the Jens Orting-Boving Company, of London, England, of which Hergert W. Kent is local manager. The contract calls for an expenditure of about $800,000, work on which will begin immediately.

ORANGEVILLE, ONT., CAN.—The Dufferin Light & Power Company has purchased the Shelburne and the Orangeville lighting plants and a water power at Hornings Mills, capable of developing 1000 hp, which it proposes to develop this coming summer. The company has also leased the Huxtable water power (156 hp), at Hornings Mills, for a term of 20 years, and at the present time is operating the Orangeville and Shelburne lighting systems from there. It is expected to have the hydroelectric power plant completed during the summer and to be able to furnish electricity for lighting the town of Dundalk by next fall. It is also proposed to furnish electrical energy for power purposes in the different towns when the plant is completed. T. R. Huxtable is manager.

OTTAWA, ONT., CAN.—Plans are being made by the Arnprior & Pontiac Railway Company to begin work on construction of its proposed electric railway which is to connect Ottawa, Fitzroy Harbour, Arnprior and Campbell's Bay, 75 miles in length, this spring. The power station and repair shops will be located at Fitzroy Harbour. Arthur Pierce, 75 Somerset Street, Ottawa, Ont., is chief engineer.

PARRY SOUND, ONT., CAN.—Plans are being considered for the installation of a series street lighting system and installation of meters this year in connection with the municipal electric light plant. G. Groves is superintendent.

LEON, GUANAJUATO, MEX.—The Electric Light & Power Company, of Leon, has sold its plant and holdings to the Central Mexico Light & Power Company, a subsidiary of the Guanajuato Light & Power Company. The Central Mexico Company will erect transmission lines to Oscar Braniff's plantation at Jalpa, and the surrounding district, to be used in connection with the construction of the large masonry dams and other irrigation development work on the plantation and to supply electricity for lamps, motors and other purposes. The company has also acquired water rights of the Guero Falls to generate electricity and will extend transmission lines to Leon and other cities and towns in this part of the state.

TAMPICO, TAMAULIPAS, MEX.—We are informed that on account of the humidity of the fuel oil the Empress de Alumbrado Electrico y Fuera Motriz de Tampico has been compelled to abandon its use and return to coal. The company is contemplating the installation of gas producers and using producer gas and gas engines and would like to communicate with manufacturers of same with a view of ascertaining the cost, etc. Cecil C. Freston is manager and chief electrician.

TORREON, MEX.—It is reported that plans submitted by Pearson & Sons for the construction of the large dam on Naxas River in this district have been approved by the Government. The entire project will involve an expenditure of about $20,000,000.

New Industrial Companies.

THE AMERICAN MOTOR LEAGUE, of Syracuse, N. Y., has been incorporated with a capital stock of $25,000 to manufacture and deal in engines, motors, motor vehicles, etc. The incorporators are: A. A. Schlachter, J. J. Barrett and S. G. Schlachter, all of Syracuse, N. Y.

THE BORGWALD COMPANY, of Mount Vernon, N. Y., has filed articles of incorporation with a capital stock of $5,000 for the purpose of doing a general contracting and construction business. The incorporators are: Frederick Borgwald, William Borgwald and George Borgwald, all of Mount Vernon, N. Y.

THE CARROLL CONSTRUCTION COMPANY, of Boston, Mass., has been chartered with a capital stock of $15,000 for the purpose of doing a general construction and contracting business by Vernard F. Carroll, of Brookline, Mass.

THE COMMONWEALTH CONSTRUCTION & SUPPLY COMPANY, of Boston, Mass., has been incorporated with a capital stock of $20,000 by John H. Broderick, William H. Glenn and James F. DeLong, all of Boston, Mass. The company proposes to do a general building and construction business.

THE ECLIPSE ENGINE & MANUFACTURING COMPANY, of Springfield, Ill., has filed articles of incorporation of $10,000 for the purpose of manufacturing engines. The incorporators are: D. M. Parkhill, C. L. Cook, J. H. Keith, D. M. Parkhill, all of Chirstopher, Ill.

THE EMPIRE ELECTRIC & MANUFACTURING COMPANY, of Plainville, Conn., has been incorporated with a capital stock of $50,000 for the purpose of manufacturing electric fittings. The incorporators are: Benjamin Lamb, J. E. Lamb and H. E. Propson, of Plainville, Conn.; J. F. Lamb, of New Britain, and W. H. Johnston, of New York, N. Y.

THE HAYDEN MACHINERY & SUPPLY COMPANY, of New York, N. Y., has been incorporated with a capital stock of $20,000 to do a general contracting business by James F. Keon, of Worcester, Mass.; E. J. Hayden and Harold C. Dayton, of New York, N. Y.

THE HYDRO POWER COMPANY, of Portland, Me., has been chartered with a capital stock of $3,000,000 to deal in engines and pumps, etc. The incorporators are: F. W. Hayden, of Randolph, Mass., and C. H. Tolman, of Portland, Me.

THE INTERSTATE CONTRACTING COMPANY, of Jersey City, N. J., has been incorporated with a capital stock of $125,000 as general contractors and engineers. The incorporators are: S. R. Ferris, J. H. C. Mitchel and F. J. Anderson, of Jersey City, N. J.

THE MACWILLIAM AUTOMOBILE COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 to manufacture and deal in motors, engines, motor cars, etc. The incorporators are: Alexander F. MacWilliam, James F. MacWilliam and John A. Bolles, all of New York, N. Y.

THE MASSACHUSETTS ROLLER BEARING COMPANY, of Augusta, Me., has filed articles of incorporation with a capital stock of $2,500,000 by F. J. Post, of Brookline, Mass.; and L. A. Burleigh, of Augusta, Me. The company proposes to manufacture bearings for use on electric and other railroads.

THE MUTUAL CONSTRUCTION COMPANY, of Columbia, S. C., has been incorporated by J. P. Matthews, John L. Mimnaugh and Allen Jones. The company is capitalized at $250,000 and proposes to do a general contracting business, developing water-powers and constructing hydroelectric power plants.

THE D. M. NICHOLS IRON WORKS, of New York, N. Y., has been incorporated with a capital stock of $10,000 by B. Franklin Grace, Harold Bouton, both of New York, N. Y., and Joseph W. Richardson, of Brooklyn, N. Y. The company proposes to do a civil, mechanical and electrical engineering business; also contracting and construction work in which metal is a factor.

THE REEVES-WALKER ELECTRIC COMPANY, of Montgomery, Ala., has been chartered with a capital stock of $10,000 for the purpose of doing general electrical construction work. The officers are: Rudolpo M. Walker, president, and Raymond P. Reeves, secretary and treasurer.

THE SANITARY TELEPHONE TRANSMITTER COMPANY, of New York, N. Y., has been incorporated by J. Tatlock, A. L. Clark and H. A. Crosby, all of New York, N. Y. The company is capitalized at $100,000 and proposes to manufacture and deal in telephone and electrical apparatus.

THE SCHENHER-ALIDOR ELECTRIC COMPANY, of Mobile, Ala., has been incorporated with a capital stock of $2,500 by William D. Schenher, Samuel C. Alidor, Rueb Baerman and Hyman Baerman. The company proposes to deal in electrical machinery.

THE SPECIAL MOTORS COMPANY, of New York, N. Y., has been chartered by A. Elliott Ranney, Arthur M. Day, Andrew J. Robinson, all of New York, N. Y. The company is capitalized at $10,000 and proposes to manufacture and deal in automobiles, motors, engines and all kinds of machines and vehicles.

THE STATE ELECTRICAL MANUFACTURING COMPANY, of Boston, Mass., has been incorporated by Charles T. Southworth and Raymond W. Averill, both of 60 State Street, Boston, Mass. The company is capitalized at $15,000 and proposes to manufacture and sell electrical novelties.

THE TITLOW WASTE HEAT POWER COMPANY, of Uniontown, Pa., has been incorporated with a capital stock of $150,000 to manufacture steam boilers, generators and other machinery to utilize waste from coke ovens.

New Incorporations.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the Link Belt Railway Company by L. T. Kitt, E. D. Kitt and W. S. Fox. The company is capitalized at $1,000 and proposes to construct a broad-gage railway in Placer County.

SAN FRANCISCO, CAL.—The Russian River Light & Power Company has been incorporated with a capital stock of $300,000 by J. E. Bennett, of San Mateo, Cal.; H. C. Eastman, of Los Gatos, Cal.; N. M. Twomey, of San Francisco, Cal.; E. R. Hough, of Kentfield, and L. R. Dickey, of Alameda, Cal. The company proposes to acquire land and water rights, to develop water power and to erect power stations to generate electricity and for other purposes.

SAN FRANCISCO, CAL.—The Hicks Electric Company has been chartered with a capital stock of $20,000 by A. A. Becker, B. C. Nelson and W. W. Hicks.

ATLANTA, GA.—The Southern Wireless Telephone & Telegraph Company has filed application for a charter with a capital stock of $1,000,000. The incorporators are: J. Pursley, Jr., George W. Derrick and Walter C. Bennett. The company proposes to establish a main office in Atlanta and install necessary stations over the surrounding country.

OLIVER, GA.—The Oliver Electric Company has been chartered with a capital stock of $30,000 by O. H. Morris, of Oliver, Ga.; George H. Miller, of Savannah, Ga., and D. G. Zeigler, of Jacksonville, Fla.

SENOIA, GA.—Articles of incorporation have been filed for the Senoia Electric Light & Power Company to construct an electric light plant. The officers are: W. B. Baggarly, president; H. L. Ware, vice-president, and H. P. Redwine, secretary and treasurer.

ARGENTA, ILL.—Articles of incorporation have been field for the Argenta Electric & Telephone Company by Samuel Gerber, Peter Gerber and Samuel O. Hilbrant. The company is capitalized at $20,000 and proposes to install an electric light plant and telephone system in Argenta.

COLLINSVILLE, ILL.—Articles of incorporation have been filed for the Citizens' Gas & Power Company, of Collinsville, by F. D. Moses, T. Fox and J. H. Siegel. The company is capitalized at $25,000 and proposes to operate an electric and gas plant.

CHICAGO, ILL.—The Chicago United Railway Company has been chartered with a capital stock of $2,500 by Charles G. Dawes, Emile K. Boisot, George P. Goover, West, Eckhart & Taylor, all of the First National Bank Building, Chicago, Ill. The company proposes to operate street railways.

CHICAGO, ILL.—The Chicago & Elmhurst Railway Company has been incorporated by Henry Williford, Jr., Henry Fearing, F. D. Kilmer, A. J. Parker, F. W. Pringle and William Rawson. The company proposes to construct and operate an electric railway from Oak Park to a point in Addison Township.

DECATUR, ILL.—The Decatur Southern Traction Railway Company has been chartered with a capital stock of $25,000 to construct an electric railway to connect Decatur and Pana, Ill. The incorporators are: William S. Carter, George H. Winsor and Henry B. Davis.

GREENVILLE, ILL.—The Bond County Telephone & Telegraph Company has been incorporated with a capital stock of $43,020 by C. D. Holles, A. M. Keith and A. J. Parsons.

NAUVOO, ILL.—The Hamilton, Carthage & Nauvoo Railroad Company has been chartered with a capital stock of $2,500 by R. R. Wallace, E. F. Jolidon, Harry M. Cuerden and Henry K. Dento, of Hamilton, and James I. Hendricks and James McCarthy, of Carthage. The company proposes to construct an electric railway from Carthage to Keokuk, Ia.

RANKIN, ILL.—Articles of incorporation have been filed for the 4-C Telephone Company with a capital stock of $55,000 by F. Samuel, R. Elaom and J. H. Davis.

JEFFERSONVILLE, IND.—Articles of incorporation have been filed for the Jeffersonville Water, Light & Power Company with a capital stock of $150,000 by James P. Goodrich, Jesse T. Moosman, of Winchester, Ind.; August C. Huey, Henry Star, of Richmond, Ind., and John S. Graves, of Chicago, Ill. The company proposes to remodel or build a water and electric light plant to supply the City of Jeffersonville and vicinity with electricity, for light, heat, power and water.

RICKARDSVILLE (R. D. WAUPETON), IA.—The Rose Valley Telephone Company has been incorporated with a capital stock of $10,000 by F. Boemecke, F. Behe, Roy Boemecke, B. E. Boyer, J. W. Farni, F. Oneyear and Nick Stoffel.

CYNTHIANA, KY.—Articles of incorporation have been filed for the Cincinnati, Newport & Licking Valley Railroad Company by R. W. Ray, of Scranton, Pa.; F. L. Fuller, of New York, N. Y.; Wade Lail, Harrison Peterson and R. H. Rees, all of Cynthiana, Ky.; T. J. Foster, W. L. Connell, of Scranton, Pa., and D. G. McVean, of Covington, Ky. The company is capitalized at $20,000, with permission to increase it to $5,000,000, and proposes to construct an electric railway from Cynthiana to Newport, Ky., a distance of 65 miles.

LEWISTON, MAINE.—The Leeds Telephone Association has been incorporated with a capital stock of $10,000 for the purpose of owning and operating telephone lines. The incorporators are: A. L. Thomas, F. H. Herrick and H. W. Lincoln, of Leeds, Maine.

GLASGOW, MONT.—Articles of incorporation have been filed for the Moore Telephone Company with a capital stock of $140,000 by R. J. Moore and others.

MISSOULA, MONT.—The Big Blackfoot Railway Company has been incorporated with a capital stock of $250,000 for the purpose of building an interurban electric railway to start from a point in Missoula County and terminate at the north line of Powell County. The directors are: John Gillie, C. F. Kelly and L. O. Evans, of Butte, Mont.; John R. Toole and Kenneth Ross, of Missoula, Mont.

QUAKERTOWN, N. J.—The Franklin Telephone Company has been incorporated with a capital stock of $100,000 to construct and operate telephone and telegraph lines in the Township of Franklin, N. J. The incorporators: M. H. Leaver, of Quakertown, N. J.; T. C. Roberson, H. K. Wright, E. E. Dalrymple, of Pittstown, N. J.

CATSKILL, N. Y.—Articles of incorporation have been filed for the Catskill Traction Company by F. N. Dubois, John H. Story, of Catskill, N. Y.; John C. Conway, of Brooklyn, N. Y., and L. G. Hechinger, of East Orange, N. J. The company is capitalized at $200,000 and proposes to construct an electric railway from Hudson River dock in Catskill, through Catskill, Jefferson, Leeds and South Cairo to Cairo.

NEW YORK, N. Y.—The Hudson Wireless Telephone, Telegraph & Power Company has been incorporated with a capital stock of $1,000 by Ebben S. Allen, of Brooklyn, N. Y.; Herban Besser, Francis Knockel, both of New York, N. Y.

WHITE PLAINS, N. Y.—Articles of incorporation have been filed for the Westchester Northern Railroad Company with a capital stock of $1,000,000. The company proposes to construct and operate a steam or electric railroad 45 miles in length, of which 35 miles will be in New York and 10 miles in Connecticut. The main line will extend from the New York, Westchester & Boston Railway at White Plains to the New York, New Haven & Hartford Railroad at Danbury, Conn. A branch, 14 miles in length, will extend from Pound Ridge to the New York, New Haven & Hartford Railroad in Putnam County. The directors are: L. S. Miller, W. A. Cokely, of New York, N. Y.; Allan Wardwell, of Lawrence; R. P. Buell, Bayside; Robert T. Bird, of Hartford, Conn.; James L. Crider, of Mount Vernon, N. Y.; John C. Gleason, of New Rochelle, N. Y., and Charles L. Nagle, of Bayonne, N. J.

CANTON, N. C.—The Canton Electric & Telegraph Company has been granted a charter to operate electric transmission lines and telephone lines. The company is capitalized at $100,000 and the incorporators are: G. H. Henson, J. N. Mease and R. H. Sorrells.

SEVERN, N. C.—The Hicks Telephone Company has been incorporated with a capital stock of $10,000 by P. T. Hicks, J. C. Stancil and others.

TYNER, N. C.—The Chowan Telephone Company has been chartered with a capital stock of $10,000 by T. C. White, of Edenton, N. C.; Dr. J. R. Parker, of Tyner, N. C., and others.

ROLETTE, N. D.—Articles of incorporation have been filed for the Ox Creek Farmers' Telephone Company with a capital stock of $5,000 by I. T. Tewten, Marion Edwards and others.

VOLTAIRE, N. D.—The Tri-County Mutual Telephone Company has been incorporated with a capital stock of $50,000 by T. E. Tostenson, John N. Peters and others.

URBANA, OHIO.—The Foreign American Automatic Telephone Company has been chartered with a capital stock of $50,000 by Borden Bowman and others.

WAYNOKA, OKLA.—The Waynoka Local and Long Distance Telephone Company has been incorporated with a capital stock of $10,000. The directors are: L. B. Collins, N. J. Collins and Charles Swindill, all of Woodward, Okla.

PORTLAND, ORE.—The Hood River Light & Power Company has been incorporated with a capital stock of $2,000,000 by John D. Wilcox, of Portland, Ore.; W. Minor and R. Smith. The company proposes to construct an electric railway from the mouth of Hood River to a poin' in the Mount Hood district.

BUTLER, PA.—The Pittsburg, Butler, Slippery Rock & Grove City Railway Company has been organized to construct an electric railway between Butler and Slippery Rock, a distance of 20 miles. Plans are also under way for the construction of a railway from Grove City to Greenville and on to Meadville, where connection will be made with the Meadville-Conneaut Lake, making a continuous electric railway between Pittsburgh and Buffalo. The directors are: W. C. Thompson, president; J. A. Smith, secretary; Dr. W. C. McCandles and A. M. Reiber, of Butler, Pa., and John C. Kerr, of Slippery Rock.

READING, PA.—The Reading Transit Company has been chartered with a nominal capital stock of $10,000 to lease the property of the United Traction Company, of Reading, and the Schuylkill Valley Traction Company, of Norristown, Pa., from the Interstate Railways. The incorporators are: H. G. Louser, of Lebanon, Pa.; George L. Roller, J. C. Murray and H. H. Reigel, of Reading, Pa.

SCRANTON, PA.—A charter has been granted to the Scranton & Lake Shore Railway Company with a capital stock of $18,000 for the purpose of building a railway three miles in length. The incorporators are: W. F. McGee, R. F. Foote, Meredith Jones, P. J. Regan and W. S. Hasler, all of Scranton, Pa.

WEST NEWTON, PA.—The West Newton Electric Company has been incorporated with a capital stock of $5,000 by A. E. DuBois, C. W. Scheck and Byron Trimble, of Pittsburgh, Pa.

WILKES-BARRE, PA.—The Wilkes-Barre Railway Company has been chartered with a capital stock of $100,000 to construct an electric railway from Wilkes-Barre, to Pittston, a distance of 10 miles. Thomas J. Connelly, of Ashley, Pa., is president.

GREENVILLE, S. C.—A charter has been granted to the Spartanburg & Greenville Railroad Company, by the Secretary of State, to construct an interurban electric line between Spartanburg and Greenville, a distance of 31 miles. The company is capitalized at $100,000, and the officers are: Charles W. Ellis, president; H. H. Price, vice-president, and C. H. Yates, secretary and treasurer.

CROCKETT, TENN.—The Crockett Ice, Electric Light & Power Company has been incorporated with a capital stock of $10,000 by H. H. Powers, W. A. Norris, Joseph Adams and others.

HOUSTON, TEX.—The Gulf Coast & Provident City Railway Company has been incorporated with a capital stock of $50,000 to construct an interurban railway to connect Pierce and Provident City, a distance of 35 miles. The incorporators are: Louis H. Schurlock, Emil Reinhold, T. J. Cougtin, of Kansas City, Mo.; Carey Shaw and James T. Reaves, of Houston, Tex. The principal office will be located in Houston, Tex.

BROWNWOOD, TEX.—The Brownwood North & South Railway Company has been incorporated by Brooke Smith, J. A. Walker, R. B. Rogers, Henry Ford and J. J. Timmins. The company is capitalized at $30,000 and proposes to build an electric railway to connect Brownwood and May, 20 miles in length.

McALLEN, TEX.—Articles of incorporation have been filed for the McAllen Ice & Power Company by R. S. Pearshing, Albert Sammons, B. H. Hooks and R. P. Boere.

LOGAN, UTAH.—The Logan Rapid Transit Company has been chartered with a capital stock of $100,000 to construct an electric railway in Logan. The officers are: David Eccles, president; Robert Anderson, vice-president and Joseph Quinney, Jr., secretary and treasurer.

SALEM, UTAH.—Articles of incorporation have been filed for the Salem Electric Company with a capital stock of $10,000. The company proposes to furnish electricity for lamps and motors in Salem. The officers are: Charles Hanks, president; Peter Johnson, vice-president; Lewis A. Hatch, secretary, and James P. Christensen, treasurer.

CHRISTIANSBURG, VA.—The Christiansburg Electrical Company has been incorporated for the purpose of constructing and operating an electric plant to generate electricity for transmission to be utilized for lamps and motors. The company is capitalized at $5,000 and the officers are: J. L. Vaughan, of Shawsville, Va., president; E. S. Hagan, vice-president; A. A. Phleger, Jr., treasurer, and H. J. Phleger, secretary, all of Christiansburg, Va.

WAYNESBORO, VA.—The Riverside Light & Power Company has been incorporated with a capital stock of $25,000 to construct and operate a light and power plant. The officers are: William A. Pratt, president; E. D. Weaver, secretary, both of Waynesboro.

ELBERTON, WASH.—The Elberton Milling & Power Company has been incorporated with a capital stock of $60,000 by L. Conrad, and others.

LAMONT, WASH.—The Lamont Telephone & Light Company has been chartered with a capital stock of $10,000 by W. R. Heglad, W. E. Soden, W. G. Barlow, W. H. Mills and G. E. Howell.

SPOKANE, WASH.—The Walking Wheel Traction Company has been incorporated with a capital stock of $100,000 by J. W. Wooley, Leo M. Casey, John T. Casey and O. W. Stone, of Spokane, Wash.

SPOKANE, WASH.—The Washington Southern Telephone Company has filed articles of incorporation with a capital stock of $100,000. The incorporators are: Charles M. Cooley, Charles R. Cushman, Lewis V. Gray, Clarence N. Thomas and D. V. Cushman.

WHITE SALMON, WASH.—Articles of incorporation have been filed for the Columbia River & Mount Adams Railroad Company with a capital stock of $20,000,000 for the purpose of building an electric railway from some point on the Columbia River in Klickitat County, through parts of Klickitat, Yakima and Skamania Counties to a point in the vicinity of Mount Adams. The company will also operate steamboats and ferries on the Columbia River. The trustees are: Adolph A. Suksdorf, E. H. Suksdorf and Oswald Suksdorf, all of Spokane, Wash.

VAN DYNE, WIS.—The Van Dyne Telephone Company has been incorporated with a capital stock of $5,100 by H. J. Haubrick, E. G. Stillmacher, William Tank and John Kand.

VANCOUVER, B. C., CAN.—Articles of incorporation have been filed for the C-W-A Lumber, Shingle, Light & Power Company with a capital stock of $50,000, by J. H. Camerson, D. S. Camerson, E. H. Wright, W. J. Andrews and H. J. Erdman.

Legal.

JOINT LIABILITY OF ELECTRIC COMPANIES FOR DAMAGES.—An action to recover damages for the death of a horse was brought against a street railway company and a telephone company. The former operated an electric railway in the City of Atlanta and furnished power for lighting and commercial purposes of the city. The wires of the telephone company were strung over those of the street railway company. It was claimed by the plaintiff that at about 7 or 8 o'clock in the evening, the plaintiff's servant was driving the bread wagon and horse of plaintiff with proper care, when suddenly the horse came in contact with and became entangled in a wire which was lying unguarded in the middle of the street, and received an electric shock which killed him. It was dark at the time, and the driver did not see the wire which lay in the path of the horse. The plaintiff charged that the wire with which the horse came in contact was that of the telephone company, which had broken in two and fallen across the wires of the street railway company; and that both wires were imperfectly insulated, and the telephone wire received a heavy charge of electric current from the street railway company's wire. Plaintiff also charged that the telephone company was negligent in having a wire that was so weak or worn as to break in two without apparent reason and was further negligent in not having sufficient insulation on said wire; and was further negligent in not having a sufficient number of guard wires under its telephone wires to prevent any of them when broken falling on the wires or to the street below. It was claimed that the street railway company was negligent in not having its wires sufficiently insulated to prevent the accident, and was further negligent in permitting the telephone company to string its wires across this street railway company's wires without sufficient guard wires. It was held that the companies were jointly liable. The damage was caused by the concurring negligence of both and the accident would not have happened if either company had been free from negligence. In 2 Cooley on Torts (3d Ed.), p. 1493, it is said: "Where the wires of two companies cross or are otherwise so related that there is danger of contact between them, there is a duty on both to guard against such contact, and for a neglect of this duty the companies are jointly and severally liable. Cases of this sort arise mainly where telegraph or telephone wires cross or parallel light or trolley wires. Where the plaintiff's store was set on fire and burned by an electric current from the defendant's trolley wire which had come in contact with the telephone wire to the plaintiff's premises, it was held that the defendant owed a high degree of care in the management of its wires, that both defendant and the telephone company were bound to guard against a contact of their wires, and that it was immaterial which wires were first installed."—Eining v. Georgia Ry. & Electric Company, Supreme Court of Georgia, 66 S. E. Rep. 237.

Personal.

MR. J. M. WAKEMAN, for the past eleven years vice-president of the McGraw Publishing Company and general manager of this journal, resigned these offices at the recent annual meeting of the company. While not in serious ill health, Mr. Wakeman feels it desirable to be relieved from business cares in order to recover his former physical condition, and his future plans include a visit of a year or more to Europe for a complete rest. After a successful connection of some years with the *American Machinist* and *Locomotive Engineering,* Mr. Wakeman joined the McGraw Publishing Company at its formation in 1899, having been one of its incorporators. As the chief assistant in the management of the company he has been a strong factor in the success which it has achieved, and as general manager of the *Electrical*

World he has guided its business career along the broadest lines and with rare ability. The departure of Mr. Wakeman will be a source of the keenest regret to his associates, and without doubt also to the host of warm friends he has made in the electrical field. Mr. Wakeman will not retire immediately, but will continue for several months as a director of the company and in active work.

MR. HUGH M. WILSON, who will occupy the office of vice-president of the McGraw Publishing Company, made vacant by the retirement of Mr. J. M. Wakeman, has passed the greater part of an active business life of twenty-three years since graduation in 1887 from Illinois College, in technical journalism. As publisher of the *Railway Age* and the *Electric Railway Review,* he gained an enviable reputation as an enterprising, successful and constructive manager of newspaper properties. He sold his interest in these publications early in 1908 and later became vice-president of the Barney & Smith Car Company, which office he has just resigned to take up his present work.

MR. J. H. WISE has resigned as civil and hydraulic engineer for the Pacific Gas & Electric Company to enter the firm of F. G. Baum & Company, engineers and contractors, of San Francisco.

MR. F. V. T. LEE has resigned his position as assistant general manager of the Pacific Gas & Electric Company, San Francisco, Cal. His plans for the future have not as yet been announced.

MR. J. P. JOLLYMAN, until recently superintendent of the Big Bend power plant of the Great Western Power Company, has been made electrical engineer for the company, with headquarters in San Francisco.

MR. BRITTON I. BUDD has been elected president of the Metropolitan West Side Elevated Railway Company, Chicago, succeeding Mr. H. G. Hetzler. Mr. Budd was formerly general manager of the company.

MR. CHAS. E. SLOANE, mining and irrigation engineer, Mr. E. B. Spaulding, electrical engineer, and Mr. F. T. Robson, civil engineer, have opened joint offices as consulting and supervising engineers in the Union Trust Building, San Francisco.

MR. P. D. WAGONER has been elected president of the General Vehicle Company, Long Island City, succeeding Mr. J. Howard Hanson, who has withdrawn from the company. Mr. Wagoner brings to his new work a wide experience in engineering and commercial affairs.

MR. BION J. ARNOLD has been appointed chief engineer of subways of Chicago, and will organize the work of constructing a system of subways for that city. Mr. Arnold is at present chairman and chief engineer of the Chicago Traction Board of Engineers, and casually engineer of the New York Public Service Commission, First District.

MR. E. J. WEHRLE, formerly superintendent of the meter department for the Hackensack district of the Public Service Corporation of New Jersey, has been transferred to the Newark district, where he will have charge of the meter department of the same company. His successor in the Hackensack district is his former assistant, Mr. William S. Davis.

MR. E. F. STONE, who has been for many years with the Norfolk & Portsmouth Traction Company, Norfolk, Va., as superintendent of distribution, has resigned in order to accept the position of superintendent of lighting and power distribution of the Pueblo & Suburban Traction & Lighting Co., Pueblo, Col. He will assume his new duties on March 1.

MOSS-ARNOLD.—The marriage of Maude Lucille, daughter of Mr. Bion J. Arnold, 4713 Kimbark Avenue, Chicago, to Mr. Le Roy Hartley Moss, was quietly celebrated on Wednesday evening, Feb. 9, at the residence of the bride's father, Kimbark Avenue, Chicago. Mr. Moss is a Purdue man, and is connected with the Chicago Telephone Company. Mr. and Mrs. Moss will reside at 5539 Prairie Avenue, where they will be at home after March 15.

MR. MAX LOEWENTHAL, electric heating expert, delivered a lecture before the electrical section of the Brooklyn Institute of Arts and Sciences at the Academy of Music on Tuesday, Feb. 8, on "The Domestic Uses of Electricity." About one hundred different domestic appliances were shown in actual operation, illustrating the various uses of light, heat and power in the home. A complete meal was prepared by a demonstrator and a large number of lantern slides were shown to further illustrate the talk.

MR. HOWARD G. HETZLER, until recently president of the Metropolitan West Side Elevated Railway Company, Chicago, has been elected president of the Chicago & Western Indiana Railroad Company and also of the Belt Railway of Chicago. Mr. Hetzler is a former steam-railroad man, and well fitted for his new position by long experience. He is a graduate of the University of Michigan and had considerable experience in engineering departments of railroads before his connection with the administrative branches of the industry.

Obituary.

MR. D. E. BARTON, of Milwaukee, died suddenly in a hotel in Detroit, on Feb. 5. Mr. Barton was the inventor of a trolley wheel, the main feature of which was that the axle was operated in a bath of oil. He was not very successful in interesting street-railway people in this device, however, and the newspapers report that he was registered under an assumed name at the hotel where he was found in a dying condition. This suggested the idea that possibly Mr. Barton committed suicide. However, it is reported that the man was suffering from kidney trouble and that very likely death was due to natural causes.

Trade Publications.

COPPER HISTORY.—The Rome Wire Company has issued a pamphlet entitled "Copper History," in which are tabulated the monthly and yearly average prices of copper from 1883 to 1910. The information contained will be found of much interest by copper users.

TUNGSTEN SIGN LAMPS.—Folder No. 3884, issued by the General Electric Company, compares the tungsten and carbon sign lamps, and shows plainly the advantages to be derived by the use of the former. It describes also the manner in which an ordinary sign may be transformed into an illuminated sign.

INTERCOMMUNICATING TELEPHONES, for residences, offices, factories, banks, etc., using desk type, wall type or flush wall type instruments, form the subject of a bulletin issued by the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y. The flush-type instrument, when fitted with the combination transmitter-receiver, makes an ideal device where neatness and convenience are prime requisites.

TRAIN DISPATCHING BY TELEPHONE, with automatic system for setting signals and recording them, is treated in Bulletin No. 1001 of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. This permits the dispatcher to set signals against a car or train at any desired point on the line and thus get into communication with the crew. All operations of signals are automatically recorded, so as to be available in case of a misunderstanding. The apparatus is in use on two large interurban electric roads.

TUNGSTEN LAMPS.—In a very attractive pamphlet entitled "The Dawn of a New Era in Lighting," the General Electric Company takes up the history of light from the tallow dip to the latest development in artificial lighting, namely, the tungsten lamp. Following the historical facts, the pamphlet is given up to the description of the tungsten lamp, its specific consumption, cost of operation and various applications of the lamp in interior lighting. The comparison of cost of this with other illuminants is taken up in considerable detail. The pamphlet is numbered 3885.

LOW-PRESSURE STEAM TURBINES.—Bulletin No. 4705 of the General Electric Company deals with turbines of both the low-pressure and the mixed pressure types, and those with horizontal and with vertical shafts. The publication relates to two cases: First, turbines in connection with engines which are run non-condensing; second, in connection with condensing engines. Horizontal turbines of this type are built with ratings of from 300 to 2000-kw, and for 25 and 60 cycles. Those of 300 and 500-kw ratings are also built for direct current. The 5000 and 7000-kw turbines are vertical and for alternating current only.

ECONOMIC THEORY OF ADVERTISING.—In a pamphlet entitled "Advertising and Its Service," the Geo. H. Gibson Co. has reprinted from the New York *Evening Post* an article discussing the economic theory of advertising, especially as regards the engineering and mechanical industries. It is shown that, contrary to current academic opinion, properly directed advertising reduces the cost of distribution of goods by providing the salesmen with a greater number of selling opportunities in a given territory and in a given time. It performs the preliminary but necessary work of informing and educating the prospective user as to the nature, possibilities and profitableness of improved machinery, thereby hastening its adoption. Greater sales, brought about through advertising, usually make possible cheaper production, thereby benefitting the community as a whole, while competitive advertising, which seems to be the especial bugaboo of socialistic writers, is also a benefit insomuch as it stimulates to improvements in the design of apparatus, and advertising is necessary in order that such improvements may meet with a prompt and adequate reward. A secondary benefit is derived from the fact that a consistent policy of advertising lessens the capital risk when new enterprises are undertaken and insures permanency to a business. In other words, advertising does not become an added burden on the consumer.

BUSINESS NOTES.

AMERICAN CONDUIT MANUFACTURING COMPANY.—Mr. H. B. Kirkland has been appointed general sales manager of the American Conduit Manufacturing Company, and will make his headquarters in Pittsburgh. Mr. Kirkland has entirely recovered from his recent extended illness.

THE W. L. CUMMISKEY COMPANY, St. Louis, has moved from the Syndicate Trust Building to 1120 Pine Street, where the entire second floor has been leased. A complete line of Jandus Electric Co. and Buckeye Electric Co. manufactures is now carried, the firm being their St. Louis representative.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEB. 8, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St. N. Y. City.]

948,321. KNOB INSULATOR; S. P. Grace, Pittsburg, Pa. App. filed June 12, 1907. A cylindrical insulator knob provided with a circumferential groove for supporting a twisted pair of wires without injuring them.

948,343. ELECTRIC FURNACE AND METHOD OF OPERATING THE SAME; A. L. J. Queneau, Philadelphia, Pa. App. filed Nov. 29, 1909. The method of treating a bath of molten metal in an electric furnace herein shown consists of providing the bath with a connection likewise of molten metal and passing therethrough an electric current so proportioned to its cross-section as to cause a series of disruptions of the connection, alternating with a series of reestablishments of the connection by the hydrostatic pressure due to the bath.

948,348. APPARATUS FOR PRODUCING HIGH FREQUENCY OSCILIATIONS; I. Schonberg, St. Petersburg, Russia. App. filed March 19, 1909. The apparatus is herein shown as provided with an oscillatory circuit having therein a sparking gap and a rectifier for arresting the oscillations when moving in one direction and for permitting them to move in the other direction.

948,374. ELECTRIC MOTOR CONTROLLING DEVICE; F. A. Hayes, New York, N. Y. App. filed Sept. 30, 1908. The switch comprises a magnet having opposed pole pieces, an armature arranged to vibrate between the pole pieces and operating means arranged to throw the armature from either normal position toward the opposite position when the magnet is de-energized.

948,379. BATTERY ELECTRODE SUPPORT; C. B. Schoenmehl and W. Straw, Waterbury, Conn. App. filed Aug. 4, 1909. An improved support for holding frame for holding the plate electrodes in their proper position one with relation with the other within a battery jar.

948,381. MAGNETIC TRACTION WHEEL DRIVE; C. Scott, Yonkers, N. Y. App. filed Dec. 16, 1905. A magnetic traction-wheel drive provided with means for decreasing the strength of the wheel after the elevator has been started and again increasing the strength of the same upon stopping.

948,404. AIR OPERATED ELECTRICALLY CONTROLLED VALVE MECHANISM FOR AIR-BRAKE AND TRAIN-STOPPING SYSTEMS; J. F. Webb, Jr., New York, N. Y. App. filed April 7, 1909. This invention embodies several different forms of air operated electrically controlled valve mechanisms for use in train-stopping and controlling systems to shut the air-brake of a train through the medium of the opening of an electric current.

948,405. AIR OPERATED ELECTRICALLY CONTROLLED VALVE MECHANISM; J. F. Webb, Jr., New York, N. Y. App. filed Aug. 18, 1909. This patent covers two specific forms of valve mechanisms in combination with an electromagnetic controlling lever device of any general type.

948,406. AIR OPERATED ELECTRICALLY CONTROLLED VALVE MECHANISM; J. F. Webb, Jr., New York, N. Y. App. filed Aug. 18, 1909. Relates to the specific construction of the valve part of an air-brake system in combination with an electromagnetic lever controlling device therefor.

948,424. SHIP DETECTOR; F. S. Long, of the United States Army. App. filed Feb. 21, 1908. A device that is adapted to be arranged in groups, the position of each being accurately plotted on a chart, each of the devices being electrically connected to a station and designed to indicate whenever a disturbing element enters its immediate vicinity.

948,426. POWER TRANSMISSION; J. G. P. Thomas, Holywell, Eng. App. filed Nov. 5, 1908. An electro mechanical system of power transmission which provides for a wide range of speed variation by the use of dynamo electric machines first as generator and motor and afterward as motor and generator, respectively.

948,441. ELECTRIC SWITCH; D. G. Butts, Chicago, Ill. App. filed Apr. 20, 1909. A push button switch designed to operate with a positive snap action.

948,442. CONTROLLER; F. E. Case, Schenectady, N. Y. App. filed Nov. 2, 1908. A controller having a handle mounted on the controller shaft, and having a limited sliding movement thereon, said handle being operatively connected to the emergency devices.

948,444. CONTROLLER; A. T. Crocker, Schenectady, N. Y. App. filed Nov. 2, 1908. A controller in which the handle is mounted on the controller shaft and arranged to rotate therewith and pivotally mounted for limited movement in a vertical plane, said handle being connected with the emergency devices.

948,504. INCUBATOR ALARM; P. Flora, Owingsville, Ky. App. filed April 16, 1909. An incubator alarm designed to sound an alarm by thermostatic action in case the temperature of the incubator rises above or falls below the predetermined temperature.

948,560. AUTOMATIC MOTOR CONTROLLER; A. E. Handy, Cranston, R. I. App. filed March 31, 1909. A controller for automatically changing the circuit conditions in electric motors.

948,563. ELECTRIC CABLE CONNECTION; W. J. Littlehales, New Britain, Conn. App. filed Jan. 28, 1909. An electric cable connection designed to be readily clasped or secured to the end of a spark plug without the necessity of employing a tool for that purpose.

948,564. FOUR-WAY ELECTRIC SNAP SWITCH; W. S. Mayer, Philadelphia, Pa. App. filed Aug. 26, 1907. A four-way electric snap switch in which movable contacts of usual form may be used.

948,567. ELECTRICAL RECEPTACLE; F. J. Russell, New York, N. Y. App. filed June 17, 1909. A plug holder adapted for delicate lamps subject to more or less vibrations, the holder being provided with means for absorbing the vibration.

948,596. TERMINAL CLAMP; H. F. Richter, Seattle, Wash. App. filed Aug. 3, 1908. A clamp designed to provide simple and inexpensive means for making terminal connections.

948,609. WIRELESS TELEPHONE TRANSMITTER; A. A. Jahnke, San Francisco, Cal. App. filed Sept. 21, 1908. A telephone transmitter adapted for wireless telephones, said transmitter having a chamber containing granular material, a porous wall, and means for supplying a volatile liquid through the walls to the chamber.

948,648. AUTOMATIC CIRCUIT CONTROLLER FOR WATER PURIFYING APPARATUS; H. B. Hartman, Pittsburg, Pa. App. filed Oct. 18, 1907. An electrolytic water purifying apparatus designed to automatically make and break the circuit to the electrode when the water is turned on or off.

948,670. ELECTRIC LAMP SOCKET; W. S. McLewee, Yardley, Pa. App. filed Feb. 18, 1908. A simplified lamp socket provided with a circuit breaker or switch for making or breaking the lamp circuit.

948,681. ELECTROLYTIC SEPARATION OF METAL; E. M. Chance, Philadelphia, Pa., and Eleanor Kent, Lansdowne, Pa. App. filed April 16, 1908. An electrolytic process for the separation of metals from mattes or speisses.

948,704. CIRCUIT BREAKER FOR ELECTRICALLY HEATED DEVICES; W. G. Nagel, Toledo, O. App. filed Feb. 11, 1909. A circuit breaker adapted for use in connection with electrically heated devices to prevent the latter from becoming heated to too high a degree.

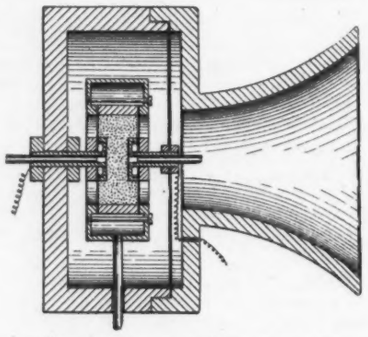
948,736. SYSTEM OF ELECTRIC GENERATION DISTRIBUTION AND CONTROL; L. Lyndon, East Orange, N. J. App. filed July 6, 1905. A system of electric generation, distribution and control in which there are no moving contacts, brushes, switches, etc., nor regulating mechanism of any kind underneath the car.

948,738. SIGNALING SYSTEM AND APPLIANCES; J. G. Nolen, Chicago, Ill. App. filed March 8, 1906. A signaling system wherein the transmission of signals will take place upon the occurrence of certain conditions in the area or device supervised.

948,624. ELECTROMAGNETIC SWITCH; R. V. Collins, New York, N. Y. App. filed March 16, 1908. A switch designed to do away with the contact controlling device or circuit changers as usually employed.

948,633. EDUCATIONAL TOY; H. B. Palmer, New York, N. Y. App. filed March 19, 1909. A toy provided with a plurality of questions and arranged to be answered by means of a plurality of answers arranged in predetermined relation to the questions.

948,639. ACCUMULATOR; M. Schneider, Radebeul, near Dresden, Germany. App. filed Sept. 9, 1908. An accumulator in which the positive pole electrode consists of superposed lead lamellae which are funnel shaped, the common axle of each being either solid or hollow.



948,609—Wireless Telephone Transmitter.

948,754. INCANDESCENT LAMP SOCKET; F. C. Aschenbrener, Chicago, Ill. App. filed Feb. 27, 1909. A socket of simplified construction adapted for use with a single pull cord for turning the light on and off.

948,758. SIGNAL SYSTEM FOR ELECTRIC CARS; F. S. Denneen, Mansfield, O. App. filed March 13, 1909. A signaling system for electric cars in which the car is provided at each end with a signal to notify cars approaching from either direction of danger.

948,764. ELECTRIC WELDING, BRAZING OR SOLDERING; O. Kielberg, Gottenberg, Sweden. App. filed Aug. 31, 1907. A method of welding brazing or soldering electrically whereby the connections on the lower sides of objects can be easily effected.

948,789. SUSPENSION DEVICE FOR TROLLEY WIRES AND THE LIKE; G. A. Mead, Mansfield, O. App. filed Oct. 7, 1907. A suspension device for flexibily suspending the trolley wire from a messenger wire.

948,817. DYNAMO ELECTRIC GENERATOR; G. Lewis, Newark, N. J. App. filed April 8, 1909. A generator designed so as to practically eliminate armature reaction and produce high speed at a maximum power.

948,873. LIGHTNING ARRESTER; B. E. Clarkson, Kingstree, S. C. App. filed Feb. 27, 1909. An improved lightning arrester of the type employing two choke coils.

948,899. SECTION INSULATOR; R. S. McFeely, Scalp Level, Pa. App. filed May 4, 1909. An improved trolley line breaker or section insulator so designed that the bar forming the trolley wheel contact may be readily removed and replaced.

948,929. SAFE AND VAULT PROTECTOR; E. Menne, Creuzhal, Germany. App. filed Nov. 8, 1909. A protector so designed that an electrical alarm will be given if heat is applied to the outside of the safe or vault for the purpose of breaking thereinto.

948,971. ARC LAMP; M. Fortuny, Paris, France. App. filed Jan. 10, 1906. An arc lamp provided with means for regulating the voltaic arc.

13,081. (REISSUE.) INCANDESCENT LAMP SOCKET; R. R. Miller, Toledo, Ohio. App. filed Dec. 9, 1907. An incandescent lamp socket provided with a lever for opening or closing circuit by a pressure of the thumb or finger in place of the ordinary rotatable key.